

BULLETIN
OF THE
AMERICAN GEOGRAPHICAL SOCIETY.

Vol. XXXIX

1907.

No. 2

LOP-NOR—A CHINESE LAKE.

BY

ELLSWORTH HUNTINGTON

PART I.—THE UNEXPLORED SALT DESERT OF LOP.

Six hundred years ago Marco Polo found one of the worst parts of his great journey from Italy to China in the desert of Lop east of Charklik. For thirty days, so he tells us, he travelled northeastward, over sandy plains and sterile mountains, through a desert inhabited only by evil spirits, which were said to lure travellers to destruction with extraordinary illusions. If, during the day, any one, so the Venetian says, should remain behind till the caravan had passed out of sight over a sand-hill, he would unexpectedly hear himself called by name in a familiar voice. Thinking the call to come from friends, he would follow it away from the road, and soon be left to perish of thirst. In the night, which, especially in warm weather, is the best season for journeying, travellers might hear the march of a huge cavalcade close at hand. Believing it to be their own party, they would follow it, only, at daybreak, to find themselves lost in the desert. Sometimes the spirits were said to assume the appearance of a body of armed men, who filled the air with the sound of musical instruments, drums, and the clash of arms, frightening the timid travellers so that they fled helter-skelter into the desert, to lose themselves and die of hunger and thirst.

The Chinese, also, tell wonderful tales of the desert of Lop. They speak especially of a part consisting of boundless muck, which swallows up man and beast. And the Lopliks, who live at the western end, tell sterner stories of the torture from thirst, the frantic search for water, and final death of the few of their number who have attempted to cross the desert in summer or fall, when the

scanty water supply is in most places undrinkably saline. Yet in ancient times, up to the second or third century of our era, Chinese records show that the main trade route from China to the West traversed this now desolate region.

In December, 1905, I found myself at the western edge of the Lop desert, ready and eager to cross its unexplored centre, not only for the purpose of learning what is really there, but in order to ascertain whether, as has been asserted, the lake of Lop-nor, now merely a reedy swamp, has been subject to great fluctuations in size during the Glacial epoch, and even during the era of history. Starting from Kashmir, India, at the beginning of April, 1905, I had crossed the Himalaya and Kwen Lun Mountains to the great Tarim, or, better, Lop basin, which extends twelve hundred miles east and west by three or four hundred north and south in the very heart of Asia, and contains some of the most impenetrable deserts in the world. On every side except the northeast it is surrounded by lofty snow-clad mountains. At their base a barren belt of typical piedmont gravel, like a vast beach of shingle from ten to forty miles wide, sucks into its porous depths all but the largest of the streams from the snowy mountains. At the lower edge of the sloping gravel plain pebbles give place to fine soil and clay and more or less of the water either reappears in springs which irrigate oases or else comes close to the surface in such a way as to support a zone of vegetation, chiefly gnarled poplars, tamarisks, and reeds. On the southern side of the basin, between Kashgar and Khotan, the zone has a width of ten or twenty miles, but farther east it diminishes to almost nothing near Lop-Nor, a thousand miles from Kashgar. All the chief oases are situated in the zone. Farther from the mountains vegetation again disappears; and the centre of the basin is occupied by two great desert areas. One of these, toward the west, called Takla-Makan, has been shown by Hedin to be composed almost wholly of huge sand-dunes ranging up to two or three hundred feet in height; the other, the Lop desert at the eastern end, was unknown except on the edges until the journey described in these pages proved it to be in large part a vast salt plain.

Now, as in Marco Polo's day, the traveller must equip his caravan for the desert at Charklik, also known as Lop. The little town consists of twelve hundred Chantos and Lopliks, as the non-Chinese Mohammedans of this part of the world are called, re-enforced by a Chinese garrison. It seemed to me quite a metropolis after two months in the almost uninhabited region to the west. Our four busy days there were enlivened by a case of justice which shows the

respect paid to foreigners. My servants and several local men of influence came to my room excitedly one day, bringing with them Handum Bai, my camel-man, whose face was covered with blood, and a sullen merchant who had lately come to Charklik from Handum's home in Keriya. It appeared that the merchant owed money to Handum. He admitted the debt, but when the camel-man insisted on his settling the matter, he refused to pay more than a small part of what the other claimed. A hot dispute ensued, and finally, so it was alleged, the merchant set on Handum, and knocked him down in the bazar. The camel-man did not seem to object to having a black eye and a bloody mouth. What troubled him was that he had been assaulted in the sight of all the people. I proceeded to hold trial to determine how much money was really due and who began the fight. Angry Handum made a vigorous plaintiff, the sulky merchant an unpromising defendant, and the most venerable of the local gray-beards a sapient jury. I served as judge, and everybody played counsel. When I called on the witnesses to testify, a dozen men began to shout at once.

"Sh! Sh!" said the gray-beards, "Where do you think you are? This is not the bazar, but the house of greatness."

By dint of much persuasion we induced the witnesses to speak one at a time, and to address me instead of arguing with one another. When I began to write down the gist of what they said, a look of surprise went over the crowd, and the old men murmured admiringly, "Ah, see that! He is writing. Now we shall have justice."

The evidence left no doubt as to the guilt of the defendant. He owed Handum two dollars, instead of thirty cents, as he claimed, and it was he who began the fight in the bazar. When I pronounced judgment, he sent his frightened nephew home in great haste to get the money. For the sake of a lesson to the people, I let the prisoner be kept in custody till the local Beg, the highest native official, could be summoned. He came at once, putting aside all business.

"This merchant," I said to him, "has assaulted my camel-man causelessly in the sight of all your people. Please take charge of him and do what is right."

An hour later a message came from the Beg:

"I have inquired into the matter with stripes." The messenger added that according to the request which I had sent privately, the prisoner had been dealt with leniently, but the punishment was sufficient to serve as a timely warning not to interfere with my men. I planned to leave two men and all of my eight horses in Charklik for two weeks; and I had found that though, when I was present, the

natives could not be too serviceable, when I was absent they were sometimes far from obliging.

Although the Chinese Amban or Mayor was out of humour because the last travellers—so it was said—had behaved outrageously, taking his ducks by force for their table, whipping people right and left, underpaying their men and making the name of Englishman hated, there was no delay in furnishing everything necessary for our journey. On December 23, 1905, I started eastward along Marco Polo's track with four men, five camels and forty-five days' provisions, the latter chiefly in the form of mutton, rice, bread, onions, dried apricots, and tea for ourselves, and linseed cake, to be fed to the camels when necessary at the rate of two pounds a day.

For the first three days to Miran the way led eastward. On the right the beach-like expanse of the vast piedmont gravel-plain sloped gently upward toward the base of the Kwen Lun Mountains twenty miles away; while on the left the view was limited by the fantastic tamarisk mounds, twisted poplars, and half-dead reeds of the zone of vegetation. At Miran on Christmas Day, we made the important discovery of the ruins of an ancient Buddhist town perhaps fifteen hundred years old, and covering an area of over five square miles. Apparently, Miran was a great religious centre. To-day the ruins consist of a large fort, a lamasery, or Buddhist monastery, with a pediment twenty feet high made of sun-dried brick like the mounds of ancient Merv and the hanging gardens of Babylonia on a small scale. The platforms support the remnants of small religious structures, either the rooms of lamas or Buddhist shrines. The most remarkable feature of Miran is, that though the ancient town probably had a population of some thousands, the modern water supply is only sufficient to support seventy or eighty people, Lopliks who come to Miran in summer from Lop-Nor, twenty miles to the north.

On reaching Abdal the day after leaving Miran, we became acquainted with these Lopliks, a fair-skinned, dark-haired mixed race, probably half Aryan and half Mongolian, who talk a Turki dialect, and dress, like the rest of the people of Chinese Turkestan, in quilted cotton tunics reaching below the knee, high leather boots and fur-brimmed caps. They are a gentle, hospitable, self-respecting people who once numbered thousands, but now are reduced to two hundred and fifty, the change, according to their own story, being due to the gradual drying up of Lop-Nor, or Kara-Koshun, as they now call the diminished lake. They live in reed houses on the marshy shores of the lake, which is really a swamp, and make

their living as fishermen, paddling their canoes of hollowed poplar through narrow lanes of reeds from pond to pond. Till eighty years ago none of the Lopliks had resorted to agriculture. They all lived on fish or wild-fowl, with a change in the spring to the soft tips of reeds and rushes, but with never a taste of bread.

At Abdal I was quartered in the single mud house among a dozen reed huts. The kindly people, knowing of our approach, and perchance thinking of the vast hoards of money which all "Sahibs," or white men from India, are supposed to possess, had chopped a hole through a foot or two of ice, and caught some fish. I asked to have them cooked and served in Loplilik fashion. Presently the mistress of the house appeared with a steaming bowl of fishy, unsalted water.

"What's this?" I asked.

"Why, that's the way you wanted it—our way. We always drink the water that the fish have been boiled in."

I omitted the Loplilik first course that day, though the boiled fish were excellent.

The fact that a woman should set food before a strange man showed that Mohammedan law is not strictly observed here. The greater freedom of home life was refreshing. It was like a breath from the West, when a girl of twelve, who elsewhere would have hidden her face in the end of her long sleeve and run away, rubbed her head against the arm of a young giant of twenty-five, and teased:

"Big brother! Let me do it!"

He was showing me how fishing nets are made from the fibre of the "Lop plant" (which, by the way, is one of the finest fibres in the world, as much tougher than hemp as hemp is than cotton). Other things, such as the absence of mosques and of daily prayers, showed that we had reached the extreme limit of Mohammedan influence. My head man, a most devout follower of the Prophet, was disturbed because, as he said, "The Lopliks are good people, but they don't have much work with God." At Keriya, when first I mentioned Lop, he had asked if it were true, as people said, that the Lopliks wore nothing but the skins of wild animals, and that they were such adepts in the art of eating fish that they could put in the meat at one side of their mouths and at the same time spit out the bones at the other.

On leaving the friendly Lopliks, December twenty-ninth, we entered what is probably the greatest uninhabited continental region in the world, outside the polar regions. In an area equal to that of Great Britain and Ireland, where the population

numbers forty million, there is not a single inhabitant. Much of it has never been visited by any explorer, or even by the natives. For thirty days of steady travelling we saw absolutely no sign of living man. Except in rare cases, there was no vegetation which even camels could eat, and no water save bitter pools. By travelling in the dead of winter when the temperature fell to zero every night, and by carefully chopping out and melting junks of hard, white ice from the midst of the yellowish, mushy material covering most of the pools, we managed to get water which, in that part of the world, is called drinkable. We were troubled with thirst most of the time, and the indigestion caused by the salt water lasted a month or two after we ceased using it. No creature but the wild camel can drink the wretched liquid permanently. Even upon that hardy animal it has a marked physiological effect. In Kuruk Tagh, after leaving the Lop desert, I once dined on wild camel. The meat was fairly good, like very coarse beef. Though perfectly fresh, in one sense of the word, it had become distinctly "corned," because of the salt which had accumulated in the animal's body from the water.

For eight days eastward from Abdal we kept close to an old strand of Lop-Nor, following a caravan road used about once a year. To the south, barren gravels stretched interminably toward the mountains; to the north the brownish-white expanse of the old lake-bed stretched sullen and unexplored to a sea-like horizon, or faded away in dusty haze. Nothing relieved the monotony except a sharp lacustrine bluff, sixty feet high, rising suddenly from the insignificant zone of vegetation. The zone was a mere strip of brown reeds, dotted with bright blue pools of brine, unfrozen because so saline. At Koshalangza, where the water was not quite so saline as elsewhere, we halted to make preparations for the plunge into the utterly unknown region to the north. We estimated that, barring accidents, we ought to reach the salt spring of Altmish Bulak in six days. The spring lay ninety miles away in an air-line, at the foot of the Kuruk Tagh, or Dry Mountains. There was no knowing, however, what delays we might encounter, or how long we might have to hunt for the spring. In such bitterly cold weather the camels could go ten days without water, or, at a pinch, twelve. Accordingly, we cut twelve days' supply of ice, and tamarisk faggots enough to last eight days if used very sparingly. This, with thirty days' provisions which still remained, twenty days' linseed cake, and the camp equipment, made the camels' loads so heavy that it was impossible for any one to ride.

We were anxious about the camels; for they had now travelled three months on comparatively poor food, with no long rests. The smallest, a truly pretty little animal, had lately developed huge and evidently painful blisters on its soft, padded feet. They were dark red and as big as the palm of one's hand. To prevent its becoming useless, the men cut off the upper portion of a pair of high, native boots, such as we all wore, and cleverly converted the lower parts into camel-shoes. The poor animal screamed like an angry, frightened child when the men tied its legs together, and rolled it over on its side; but it seemed decidedly grateful when, on rising, it found that its feet were no longer so painful. We nearly doubled up with laughter, for it shook its ungainly feet as a cat does hers when a small boy ties paper on them; and then walked off with its hind legs a yard apart.

A hearty laugh was good for the anxious men. At Charklik I had told them that we were going to a difficult and dangerous region where no man had ever been, and they could turn back if they wished.

"No," they answered, "we have seen that with a piece of paper and a 'Mecca-pointer' [compass] you can find a road where there is none. If we die, we die. Allah is merciful."

At Koshalangza I gave them another chance to go back, but they swore that they were not afraid. They call the compass a Mecca-pointer" because the only practical use of it that they appreciate is that it shows the direction in which to face when they say their prayers.

For four weary days we stumbled northward across the interminable salt plain of the old lake-bed. Rough! An ordinary frozen ploughed field would have seemed like a macadam road in comparison. Imagine the choppiest sort of sea with white-caps a foot or two high, and freeze it solid. When we camped in what we hoped was a soft spot, and tried to drive in the iron tent pegs, most of them bent double. We had to use an axe to hew down hummocks of rock salt a foot high before we could get places smooth enough for sleeping. Each night, when we pulled off our soft-soled boots, the only kind in which we could keep warm, we realized how the bastinado must feel. The slowness of our stumbling progress, the boundlessness of the sea-like horizon, the bitter morning wind, and the uncertainty as to when we should find something different made us feel that the old lake must have been endless.

During the long-continued process of drying up, the ancient lake of Lop deposited an unknown thickness of almost pure rock salt.

When the salt finally became dry, it split into pentagons from five to twelve feet in diameter; the process being similar to that which gives rise to mud-cracks when a mud-puddle dries up, or to basaltic columns when lava cools. The wind, or some other agency, apparently deposited dust in the cracks; when rain or snow fell, the moisture brought up new salt from below; and thus the cracks were solidly filled. When next the plain became dry, the pentagons appeared again. This time the amount of material was larger, and the pentagons buckled up on the edges, and became saucer-shaped. By countless repetitions of this process, or of something analogous to it, the entire lake-bed became a mass of pentagons with ragged, blistered edges.

Twice we encountered faint hollows where for a mile or two the plain was damp and comparatively smooth. Travelling in such places was much easier than elsewhere; but we did our best to avoid them, for we remembered the Chinese tales of muck which swallows horse and rider. Beyond the main body of the lake our worst fears were almost realized. The salt assumed a whiter, fresher appearance, and began to look slightly damp. I was riding the biggest of the camels whose load of wood and ice had now been partly used. Suddenly I found myself turning a summersault backward off the camel. His hind legs had broken through the saline crust and had plunged a yard deep into soft, oozy muck. As he struggled ponderously to extricate himself, his front legs also sank in; and oily water came bubbling up in muddy pools about the prostrate creature's stomach. Two other camels fell into the mire at the same time. In the haste with which we began to tear off their loads I forgot to investigate whether my neck was broken. Relieved of their burdens, the two smaller camels extricated themselves. My big, heavy animal, however was so completely mired that we had to put ropes around his legs and pull them out onto felts which we spread on the soft mud to keep him from sinking in again. It was a grim jest on the part of Nature to lead us into an unfrozen, watery bog in zero weather, in a region so cold and dry that we were carrying ten or twelve days' supply of ice for drinking-water. If the mud had been a little softer we should have lost the camels, and might never have returned to corroborate the Chinese tales of bottomless muck.

On the fourth morning of our weary march we were cheered by encountering a shore-line, marked by a steep bluff thirty feet high. On climbing to its top we supposed that we had left the old lake-bed behind. After walking a quarter of a mile among æolian *mesas* of clay, however, we dropped down another bluff, and were in the salt

plain again. We had crossed a finger-shaped peninsula, ten or twenty times as long as it was wide. All that day and till noon of the next we encountered similar peninsulas, or elongated islands, separated by bays and sounds of similar dimensions. The axes of all were directed northeast and southwest, as the map shows. Apparently, during a dry interfluvial epoch preceding the last marked expansion of the lake, the violent winds of the region, which prevailingly blow from the northeast, had carved out great hollows between countless *mesas*, as they are doing now in many other places. Later, when the lake again expanded, it penetrated the hollows and widened them into a network of parallel sounds and bays, dotted with an archipelago of elongated islands and peninsulas. The flat-topped islands, with steep red and green bluffs surrounded by the clear blue water of the bitter sea, must have presented a unique and almost indescribable type of scenery.

Beyond the fatiguing sea of salt we found easy travelling for a time. A fantastic red plain, the soft dry bed of an older expansion of the lake, glittered with innumerable gypsum crystals, or was sparsely studded with aeolian *mesas*, made of pink and greenish clay, and from thirty to sixty feet high. On the sixth day the red plain gave place to a maze of *mesas*. As we were travelling at right angles to their long axes we were obliged to make countless huge zig-zags in order to find breaks through which the camels could pass. Nevertheless we made fourteen miles that day, and by sunset were close to the mountains of Kuruk Tagh, and only eight miles from Altmish Bulak. Shortly before we camped a regular cheer went up from the men.

"Wood has come! Wood has come!" they shouted. Sure enough a few bits of drift-wood lay in a long-dry flood channel. It was the first sign of life, or of the work of running water, that we had seen for six days. No; not quite the first sign of life. We had found in the salt a half-buried plover, dead for centuries, ever since the time when the bottom of the lake was still soft and formed the muck of the Chinese tradition; and elsewhere, in the side of a mesa, we had seen the deeply-buried roots of some reeds which flourished long ago in the expanded Lop-Nor of one of the earlier Glacial epochs. Otherwise, for nearly a hundred miles, the entire country was as barren as a well-used road.

"We came just as though we had been here before," said the men when we reached Altmish Bulak on the seventh noon. The camels had suffered from hunger more than from thirst. In spite of seven days without water, they would not drink till they had filled their

stomachs with reeds and prickly camel-thorn. For ourselves the greatest difficulty had been lack of fuel. The night temperature had averaged nine degrees below zero Fahrenheit, with a minimum of seventeen below. Two or three sticks, fed slowly together, had not made a very satisfactory fire, but we dared not use more for fear of some delaying accident. Some nights I had to write with a pencil, because my fountain pen froze in my hand, though I held it as close to the fire as possible. One night I actually had to eat dinner with my plate in the fire to keep things from freezing. Yet, thanks to vigorous exercise, none of us suffered from cold, except when the wind blew.

At Altmish Bulak we rested a day, chopping new ice, cutting faggots, and getting ready for a start the next morning toward the ruins of Lulan, thirty miles to the southwest. When Handum Bai went to bring in the camels he could not find them, though he and the others searched till dark. Only one remained, the little footsore animal, which we had kept at home that afternoon to have its shoes patched. During the next twenty-four hours we watched and tended that camel like a sick child. The chances were that we should never find the others. If we threw away everything except food, furs, and instruments, and abandoned all hope of further exploration, the weary little animal might be able to help us to Tikkenlik, the nearest settlement, a hundred and fifty miles away. If it became exhausted, as there was every chance of its doing, or if it succeeded in its vigorous attempts to run away and seek its mates, we should be in a sorry plight. If we should have to go on foot to Tikkenlik, carrying even the minimum of food, furs, and ice, and following a circuitous route in order to hunt for springs at the foot of the mountains of Kuruk Tagh, it would probably take us twelve, or perhaps fifteen, days to get there. Failure to find water, sickness, or untoward accident, such as injury to the compass, might mean that we should never emerge from the desert.

I decided to spend two days in hunting for the camels, and then, if we were unsuccessful, to try for Tikkenlik on foot. The track of the runaways must be visible somewhere in the soft sand or gravel. I told the men that if we found it the discoverer was by no means to go off alone in the vast, pathless desert, but to come back to camp for a companion, and for food and ice. During that anxious night it was hard to refrain from repeatedly getting up to make sure that the little camel had not escaped. In the morning we found that Handum Bai had gone off alone, nobody knew when or where. We finally found his track, and that of the camels, leading off to

the southwest down the slope of piedmont gravel. It did not deviate to right or left like the track of animals in search of food, but ran straight away as though they had been led. Handum's track showed that he had been running—an amazing thing for an Oriental to do. Ibrahim, my headman, and our Loplik guide followed the track some miles, but came back at three o'clock with no news. As Handum had opened none of the food bags, and had left his coat in camp, I began to feel more anxious about him than about the camels. If he lost his way, or went too far, a night without food, water, fire, or furs, and with a temperature of ten degrees below zero, after a day of severe exertion, would probably kill him. Accordingly, I started the two men off again, with the tired little camel loaded with everything necessary, including faggots and ice. They were to follow Handum's track till dark, camp where their fire could be seen from afar, go on till near night the next day, and then, if neither Handum nor the camels had appeared, turn back, leaving a cache with his coat, and plenty of wood, food, and ice.

The Ladakhi cook and I remained in camp. Abdur Rahman, as he was called, feeling lonely and disconsolate, prepared for the hoped-for return of his companions by cooking the favourite Ladakhi dish, lumps of highly-spiced, heavy dough boiled in fat, and eaten, if possible, with buttery Himalayan tea. Coming to my tent after sunset, ostensibly to tend the fire, he was whiling away the time by telling me about what he had cooked, when we heard a faint hallo borne on the strong west wind. Hurrying to the top of a bushy hillock, whither our anxious feet had worn a path that afternoon, we peered into the darkness, and, after vainly shouting again and again into the teeth of the wind, kindled a big fire. Then we waited a disquietingly long interval. We had almost concluded that we were mistaken as to the voice, when it sounded again, near at hand, and in a moment the firelight showed Handum Bai, with bowed head, striding wearily through the reeds with the huge two-humped camels behind him.

He was out of his head. Fatigue, hunger, thirst, and anxiety had unsettled the poor man's wits, never any too keen. All that we could gather was that he was trying to explain why he had gone off alone contrary to orders. The next day he was able to give a more coherent account, though it was weeks before he was himself again. Apparently the camels would not have run away if Handum had heeded the cook's warning that they were beginning to stray at three o'clock. At bed-time, eight o'clock, Handum Bai was in anything but a pleasant frame of mind.

"If the camels are lost and we die here in the desert," he said to himself, "it will be my fault. This is the mating season, and our camels have surely gone off after the wild camels which come here to drink. They may go a hundred miles without stopping. If I wait till morning, and go with another man, the camels will have such a start, and we shall go so slowly, that we will never catch them. The Sahib will be angry if I go alone; but he will be still more angry if the camels are lost and we all die."

Waiting till the moon rose, between nine and ten o'clock, he stealthily crept out, taking nothing but some matches. How he found the track I do not know. But find it he did, and ran beside it all night. Once his unprotected hands got so cold that, finding a tiny bush a foot high, he stopped to make a little blaze. At the same time he ate a bit of snow which had been preserved under the bush since the only snowstorm of the winter, a couple of inches which had fallen six weeks before. Otherwise he neither drank, ate, nor rested.

"I vowed when I started," he said, "neither to eat, nor drink till I found the camels, or got back to camp. And I vowed to run all night as hard as I could, and to spend the day in coming back to camp. I knew it would take all day to come back if I ran all night, because it would be uphill. And I knew a night in the open would kill me."

It was well that Handum Bai acted as he did. The undeviating tracks and the wild camel seen by him left no doubt that our animals had been led off by wild ones. Ours probably never came near the others; for it is well known that the wild camel is extremely afraid of anything which suggests man—for instance, the saddles which we always left on to keep the animals warm in the winter. Two of our camels fought on the way, as Handum Bai knew from the tracks. Fortunately, the saddle of the big leader was knocked off, and, becoming caught to the animal's hind foot by a loose rope, not only acted as a clog, but made a broad track, easy to follow. At day-break Handum entered a region where the wind had cut the clay plain into little mesas, thickly set, a hopeless labyrinth of narrow passages. He despaired of finding anything, and was about to turn back. Suddenly he spied a black spot, conspicuous among the pale green and gray of the region; it was the big camel's head rising over a table of clay. The saddle had stuck in a narrow passage between two elongated mesas, and the animal was caught in a veritable trap. He bit so furiously that Handum could not catch him, and was obliged to go off for the others, which, deprived of their leader, were

straying slowly not far away. Finally, with a rope from the neck of a small camel, he caught the big one, and was ready to return. As he looked around to find how to get back to camp, he suddenly noticed the sun rising in the *west*, and wondered what the evil spirits were doing. He started off, however, on his old track, only after half an hour to find himself back where he started. He rubbed his eyes. The spirits must be playing with him, he thought. He had sense enough to examine all the tracks carefully, and discovered that he had followed his own track, made in catching the milder camels. If the spirits had been clever enough to raise a little wind and cover the tracks, it would have been the end of Handum Bai, and, perhaps, of the rest of us. As it was, he chose the right track. Once he tried to ride, but found it too cold. In the late afternoon he foolishly attempted to make a short-cut, thus failing to meet the other two men, and almost getting lost again. Toward sunset he thought that over the rock-ribbed plain of gravel he saw the reedy plateau of Altmish Bulak, rising ten feet above the surrounding dry flood-plain. After dark he supposed himself near the camp, but hearing no answer to his repeated shouts, was about to pass on and camp near the mountains, perhaps to perish of cold. He was planning, so he said, to make the four camels kneel in a square, and crouch down in the middle out of the wind. Then our fire flared up far to the right, and he was saved.

The two men whom I had sent off with the feeble camel found Handum Bai's track the next day, and returned in the afternoon without incident. Judging by what I later saw of the topography, the man must have travelled twenty-five miles each way in his chase after the camels—fifty miles in twenty hours without food or water. The experience was to me a revelation of the inexorableness of the desert. It was still more remarkable as an illustration of the intensity and endurance which life-long contact with the desert in the care of his camels had developed in Handum Bai, a man of the mild Chanto race. None of my other men would have done such a thing, only Handum, who from early childhood had endured heat and cold and fatigue in the desert far from the enervating influence of the easy agricultural life of the fertile oases. Such intensity is often supposed to be a result of Mohammedan fanaticism and fatalism. More probably it is the result of life in the desert. There none succeed except those who, though often lazy and dilatory, are capable at times of becoming almost monomaniacs—fanatics animated by the will to do some deed in spite of heaven or hell.

THE Isthmus of Tehuantepec and the Tehuantepec National Railway.

BY

EDMUND OTIS HOVEY.

On the 23d day of January, 1907, General Porfirio Diaz, President of the Republic of Mexico, with impressive ceremonies touched the electric button that set in motion a travelling steam crane which transferred from the steamship *Arizonian* at Salina Cruz, on the Pacific Ocean side of the Isthmus of Tehuantepec, to a waiting freight car the first bit of cargo to utilize the great new interoceanic route which has just been completed by the English construction firm of S. Pearson & Son under contract of partnership with the Mexican Government. On the following day the car of freight, accompanied by the President's special train, was taken across the Isthmus to Coatzacoalcos on the Gulf of Campeche, where the goods were put into the steamer *Louis Luckenbach* for conveyance across the Atlantic Ocean, thus actually opening to the commerce of the world a route which has been worked at spasmodically for a generation. The Mexican Government and the constructors of the railroad and port works, with Sir Weetman D. Pearson at their head, believe that the Tehuantepec line will do an enormous business and be a profitable enterprise from the start, and that it will compete successfully with the Panama Canal when that has been completed, or that at any rate there will be plenty of traffic for both routes.

The Isthmus of Tehuantepec, in the States of Vera Cruz and Oaxaca, Mexico, is only 125 miles across in a bee-line from the Gulf of Mexico to the Pacific Ocean. The vast mountain ranges and systems of the northern and central portions of North America converge rapidly in Mexico until, in this region, the hundreds of miles of breadth have dwindled to a few tens of miles and the thousands of feet of elevation have diminished to a pass only 800* feet above the sea at its highest point. This is the most northern break in the continental backbone of the mountains, and hence has long been prominent in the minds of the civil engineers of the world, as offering a practicable route for the economical transfer of interoceanic freight from the Atlantic to the Pacific and *vice versa*.

* The elevations cited in this article have been taken from Böse, "Excursions à l'isthme de Tehuantepec." X Congr. Géol. Int., Guide au Mexique, XXXI.



Study of the map shows that the route from the Atlantic and Gulf ports of North America across the Isthmus of Tehuantepec to the west coast of North America and other north Pacific ports is from 1,000 to 1,900 miles shorter than the route across the Isthmus of Panama, while from Liverpool the difference is from 800 to 950 miles in favour of Tehuantepec. The average saving in distance from New York is about 1,250 miles, which means a reduction in time of five days at the usual rate of speed of a freight steamer, and a still greater economy of time for sailing vessels. This saving, however, will be partly offset by slower handling of freight across Tehuantepec than across Panama.

Although it is now admitted that Hernan Cortes, the Spanish explorer and conqueror, probably never conceived the idea of building a canal across the isthmus, his letters to his Royal Master show that he appreciated the importance and advantages of a water communication between the oceans and that he had some knowledge of the Tehuantepec region—in fact, he crossed the isthmus on his expedition into Honduras. Cortes was so much pleased with the country that he asked and obtained from Emperor Charles V an extensive grant of land, comprised in the haciendas of Tarifa, Chicapa, and La Venta. These estates remained in the possession of descendants of the conqueror for several generations; and even to this day they are known as Las Marquesanas, or the haciendas of the Marquis, Cortes having been made Marquis of Oaxaca by the Emperor.

Fragmentary surveys were made by the Spaniards in the sixteenth and eighteenth centuries, which are said to be more than merely creditable pieces of work for their periods. Time after time it has been proposed to construct a canal across the isthmus, the first of these plans seeming to have been formulated by Agustin Cramer, an engineer of repute and Governor of the fortress of San Juan de Ulua, Vera Cruz, who was sent out in 1774 by the Viceroy de Bucareli to survey the isthmus. Since 1847 many concessions for railroads or rail and water routes have been granted by the successive Governments of Mexico, some to American, some to European, and some to mixed companies, but bad luck seemed ever to camp on the trail of an individual or a company trying to open an avenue of interoceanic communication across Tehuantepec. Captain James B. Eads, a famous American civil engineer, proposed a scheme which received much popular notice for building a railway that was to be fitted up for receiving a ship bodily from one ocean, carrying it across the Isthmus and setting it afloat again in the other, but the plan was too costly to be feasible.

The first rails of a transisthmian road were laid between 1878 and 1882 under a concession granted to Edward Learned of New York. Only 35 kilometers (22 miles) had been built when the work was abandoned and the concession declared forfeited. Then Don Delfin Sanchez obtained a concession and managed to construct about 73 kilometers (46 miles) by April, 1888, when his grant was annulled. He had contracted to finish the whole road by February 28, 1885, but two-thirds of the task remained to be touched when his connection with the enterprise ceased. The next contract was with Edward McMurdo on the basis of a loan floated by the Mexican Government in London, Paris, and Amsterdam in 1888. McMurdo died before the contract could be carried out; but it was not until January, 1892, that his widow relinquished her claim on the Mexican Government. On the 27th of February, 1892, an agreement was signed by the Government, and Messrs. Hampson, Stanhope and Corthell, in accordance with which the line was to be finished by September, 1893. Funds, however, gave out, and again was the contract cancelled and the work stopped. Fifty-nine kilometers (37 miles) of road remained to be constructed, and, a new loan having been negotiated, a contract was signed December 6, 1893, by which Mr. Chandos S. Stanhope, of the preceding firm of contractors, agreed to complete the work in nine months.

The road was finally opened to travel in 1895 after forty-five years of spasmodic effort and the expenditure of \$32,000,000, but it was realized that the route was not in physical condition for the accommodation of interoceanic traffic, and that such traffic could not be expected for the railway until after safe and commodious harbours had been provided at the terminals of the road. Coatza-coalcos, on the Gulf side, could only receive vessels of less than twelve feet draught of water on account of the bar at the mouth of the river, and there were no docks or wharves; while at Salina Cruz, the Pacific terminus, there was nothing but an open roadstead, which offered an extremely insecure anchorage for vessels. These considerations and the necessity for providing for the efficient operation of the road and harbours after everything should be in order for business led to a revised and more comprehensive grasp of the situation on the part of the Government.

The present history of the Tehuantepec route dates from 1896, when an enabling act was passed by the Federal Congress which authorized some proposed contracts with a private corporation for carrying on the whole enterprise. The firm of S. Pearson & Son, Ltd., was the one which President Diaz and his Ministers selected for

the work, the firm having won favour in Mexico through having completed the great drainage canal for the basin of Mexico City and the extensive port works at Vera Cruz. The first contracts with the Pearsons for the Tehuantepec work were signed in 1898, but those now in force were not ratified until May, 1902, and modifications in these were made two years later. The history of the Tehuantepec concessions has always been one of constant changes. The agreements between the Mexican Federal Government and the Pearson firm provide for a joint partnership for fifty-one years from July 1, 1902, between the contracting parties for the construction, maintenance, and operation of the Tehuantepec National Railway and the ports of Coatzacoalcos and Salina Cruz.

As outlined in "Modern Mexico" for March, 1905, the corporate capital is \$7,000,000, furnished equally by the partners, and the disposition of the annual earnings is as follows: (1) Payment of operating expenses, maintenance of track, etc., and formation of a reserve fund for repairs; (2) Payment of interest on loans; (3) Payment to the two partners of an interest of 5 per cent. on the capital furnished by them; (4) Refundment of losses in previous years which were charged to capital; (5) Payment of interest at 5 per cent. per annum on the capital devoted to the Coatzacoalcos port works; (6) The surplus to be divisible between the Government and the contractors as follows: During the first thirty-six years 65 per cent. to the Government and 35 per cent. to the contractors; during the next five years, 68½ per cent. to the Government and the remainder to the contractors; during the next five years 72½ per cent. to the Government and the remainder to the contractors; in the last five years, 76½ per cent. to the Government and the remainder to the contractors." The sum advanced by the Mexican Government for the prosecution of the work has amounted to about \$33,000,000 gold.

The new route begins active life with a contract for the entire freight of the American-Hawaiian Steamship Co., which assures a business of at least 500,000 tons of sugar and other cargo. The Company has been operating by way of the Straits of Magellan, but with the completion of the Tehuantepec railway and harbours two new lines go into commission, one from New York to Honolulu and the other serving the coastwise traffic between Salina Cruz and the Pacific ports of the United States. When the Union Iron Works of San Francisco have finished the three ships now building for the American-Hawaiian Co., four 8,000-ton steamers will ply between New York and Coatzacoalcos, six 12,000-ton boats between Salina



FIG. 1.—ALONG THE ROUTE OF THE TEHUANTEPEC RAILWAY. A NATIVE VILLAGE OF THE TEHUANA INDIANS ON THE COATZACOALCOS RIVER.

Cruz and Honolulu and two 6,000-ton ships will care for the coast-wise trade. The Magellan route will be abandoned, if not already given up at the present writing. This contract is binding only until the Panama canal is opened to vessels, when it may be cancelled by either party. The maximum rates of passenger and freight have been fixed by the Mexican Government, and are: First-class passenger about four cents per kilometer (five-eighths of a mile), Third-class, two cents. First-class freight will pay eight cents per ton per kilometer, while the cheapest cargo will cost three cents per kilometer-ton. These rates are in Mexican silver, which is approximately one half the value of American currency.

The railway consists of the main line, 310 kilometers long, from one harbour to the other, and a branch 28 kilometers long from Juile to San Juan Evangelista. The road is of standard gauge, with rails 80 pounds to the yard on the main line, laid on ties of creosoted pine, native hardwood and California redwood. Heavy steel tie-plates are used on all the ties. The roadbed is now in excellent condition throughout, about half of the line being ballasted with gravel and most of the remainder with broken rock. Seventeen kilometers have "natural" ballast. The bridges are all substantially built in permanent fashion, with stone abutments and heavy steel spans. The bridge, 560 feet long over the Jaltepec River at Santa Lucrecia, is the largest on the line. It is a massive five-span structure suited to the support of the heaviest trains. The management is looking forward to and preparing for the double-tracking of the road within a few years.

An important item of the expense of maintenance on the Isthmus is the treatment of the vegetation on and along the right of way. Trees and brush are kept cut down on either side of the track, but mechanical means are inadequate for the economical destruction of the weeds on the roadbed, and the operating company has adopted a chemical which is applied hot under pressure by means of a steam atomizer from a tank car and kills roots as well as superficial growth. It is said that the Tehuantepec was the first railway in Mexico to use oil-burning locomotives. The oil has been brought to Coatzacoalcos by steamer from the Texas fields, but important oil-bearing sands, supposed to be of Tertiary age, have been tapped on the Gulf side of the Isthmus, and these are expected to supply all the needs of the railway and the ports. There is a great 1,500,000 gallon storage tank at Coatzacoalcos that receives the oil, and from this it is distributed to 6,500 gallon tanks at convenient places along the road.

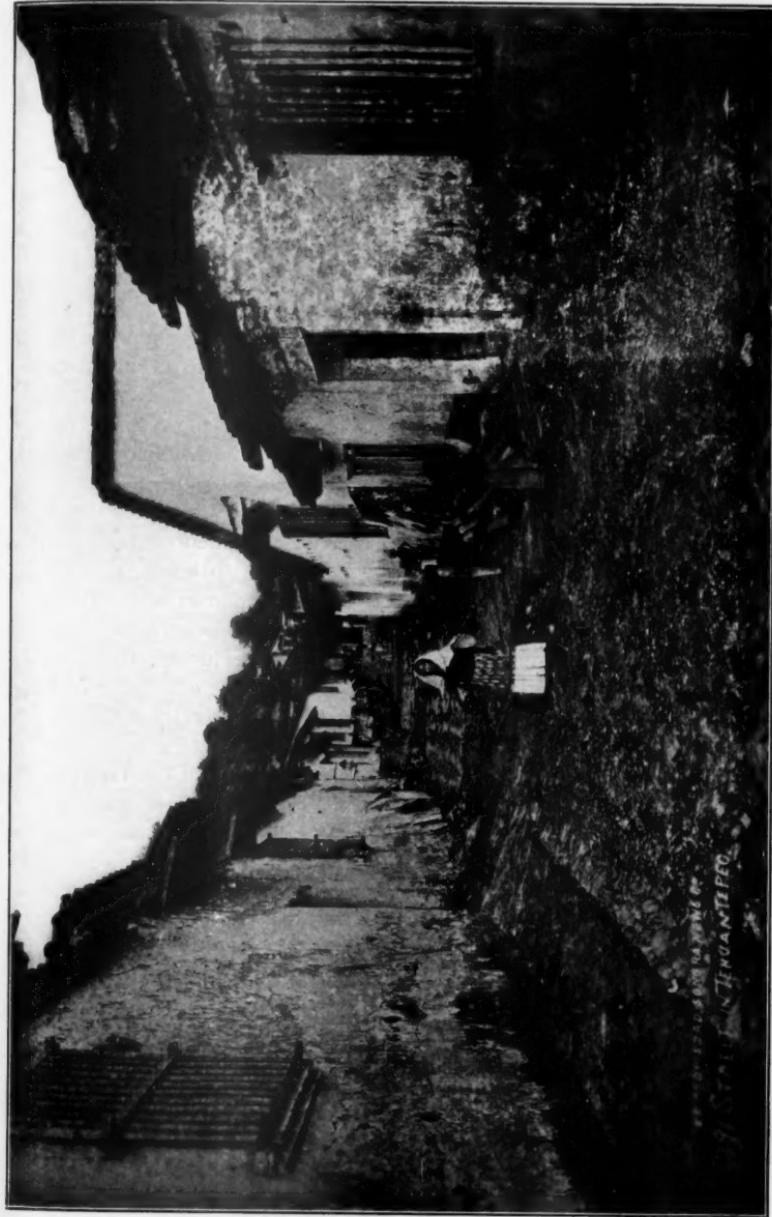


FIG. 2.—A SIDE STREET IN TEHUANTEPEC, THIS CHIEF TOWN OF THE TEHUANA INDIANS.

Car-building and repair shops and the administrative offices of the company have been established at Rincon Antonio, a town which has been called into existence by the needs of the railway. The site of the town is a broad plain about 575 feet above the sea, surrounded by mountains and enjoying a comparatively good climate by reason of the winds that constantly sweep across the Isthmus. It is 204 kilometers (128 miles) from Coatzacoalcos. Rincon Antonio is a new town, and therefore not picturesque; but it is clean and flourishing, and the Indian inhabitants, who live by themselves, appear contented. The general manager of the railroad, Mr. J. N. Galbraith, is an American, and most of the other chief officials are either Englishmen or Americans. They all live in a group of handsome, commodious houses on a hill overlooking the town and commanding a fine view of the surrounding country. Another group of comfortable dwellings has been provided for the clerks and other skilled employés of the company. Life at Rincon Antonio is said to be very pleasant. The building and repair shops are up to date in their equipment, all power being transmitted by electricity, and there is a well-appointed foundry connected with them.

Although much heavy construction work had to be done in the Malatengo Cañon for a distance of 9 miles and over the Chivela Pass (800 feet above the sea) for about 24 miles, where there are two horseshoe curves, several bridges, and one tunnel, the most stupendous pieces of engineering connected with the enterprise have been the providing of terminal facilities and safe harbours at Coatzacoalcos and Salina Cruz. At the former place the great Coatzacoalcos River, which drains the whole northern side of the Isthmus, forms a natural harbour of unlimited capacity, which was discovered by an expedition sent out by Cortes. The mouth of the river was obstructed by a bar on which there was only 12 feet of water at low tide. Two stone jetties, each about 1,300 meters (0.8 mile) long, have been thrown out into the sea, which are expected to maintain the depth of 10 meters (32.8 feet) which has been given the channel by dredging.

Wharves aggregating a frontage of more than 3,280 feet have been built, so that vessels drawing 33 feet of water can lie alongside. On and beside the wharves several great warehouses and an extensive system of tracks have been installed beside the river bank, so that powerful travelling steam cranes can take cargo from the ship, and, with one handling, deposit it directly upon freight cars or in the warehouses, as need may demand. The roofs of the warehouses have been built with removable hatches, to permit the direct transfer of freight from ship to storage and *vice versa*.

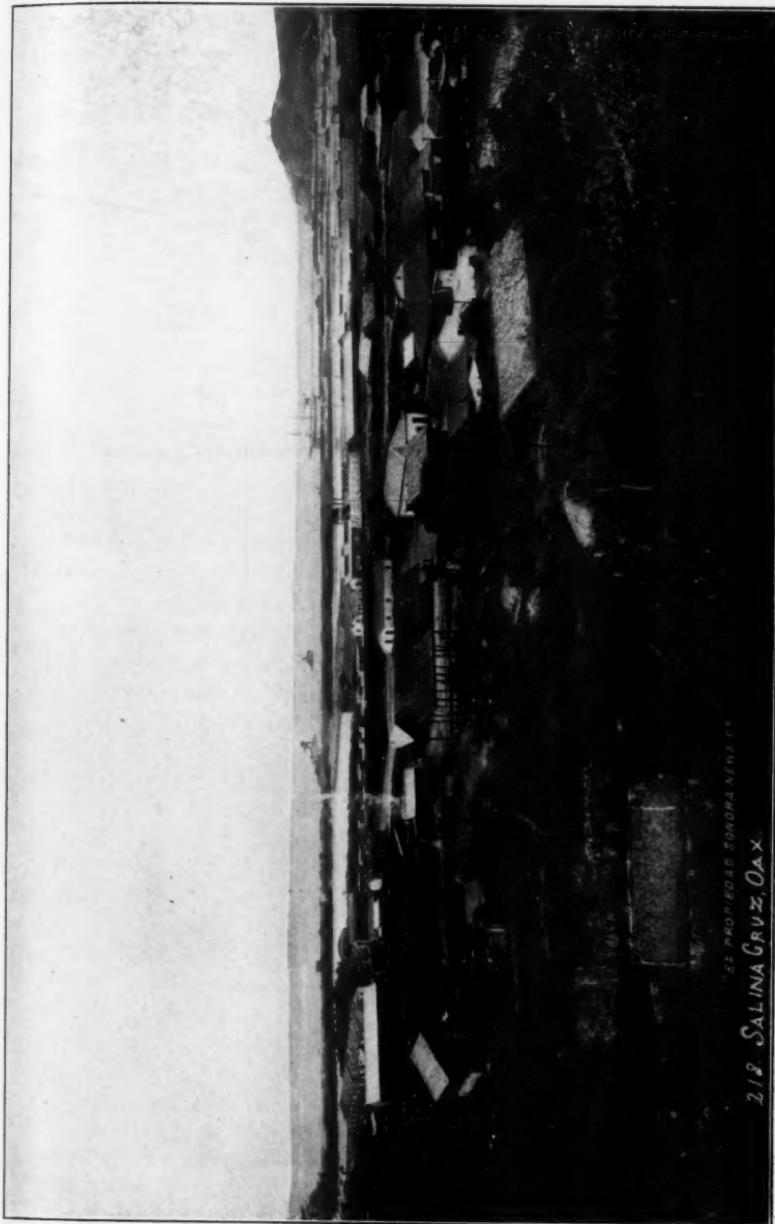


FIG. 3.—SALINA CRUZ, OAXACA, MEXICO. THE NEW TOWN AT THE PACIFIC TERMINUS OF THE TEHUANTEPEC RAILWAY.

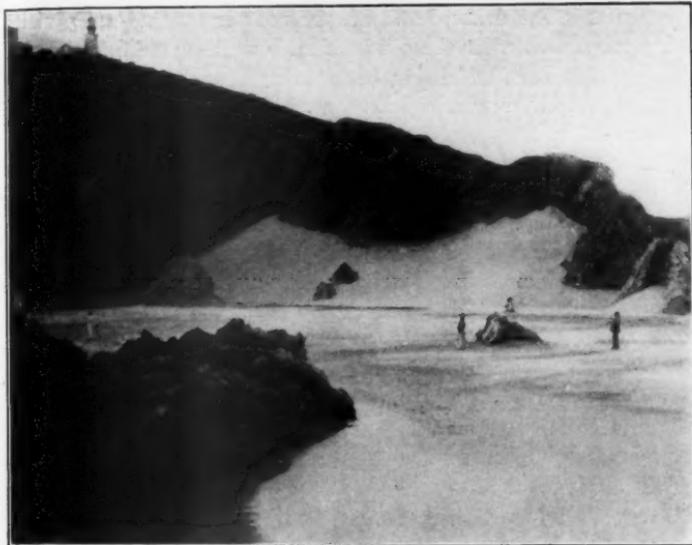
The terminal freight yard occupies swamp land which has been filled in with clean gravel, incidentally greatly improving the healthfulness of the town. When completed, this yard will cover 480,000 square yards of land which has been gained by the use of 931,000 cubic yards of filling and will be gridironed with tracks aggregating more than 13 miles.

On the Pacific coast there was no natural harbour that could be used as the terminal for the railway. The Tehuantepec River, the largest of the streams along this part of the western slope, is a small stream when compared with the Coatzacoalcos, and it loses itself in a series of lagunas, or ponds, which gave no promise of the economical construction of a safe and commodious port; hence it has been necessary for the Mexican Government and the Pearsons to make an artificial harbour for the Pacific terminus of the Tehuantepec Railway, and this has been done at Salina Cruz. Formerly there was an open roadstead at this point, which acted as an insecure stopping-point for the coast steamers, and a little town eked out a miserable existence on the small trade which was carried on. The present town is an entirely new one, which has been built by the Pearsons on a healthful site overlooking the new harbour that occupies the place once utilized for streets and buildings.

The new harbour is double, consisting of an outer portion, or harbour of refuge, and an inner basin. The outer harbour has been formed by the construction of two massive breakwaters thrown out into the sea. The eastern of these is five-eighths of a mile long, while the western is only about one-half as long. The opening between them is 220 yards wide, with 66 feet of water at low tide. The inner harbour has been formed by excavating the site of the old town of Salina Cruz so as to form a basin which is now five-eighths of a mile long, and 700 feet wide, with 33 feet of water at low tide. Warehouses and tracks have been provided here on the same extensive scale as at Coatzacoalcos.

In the northwest corner of the basin there is under construction a dry dock about 600 feet long and 100 feet wide, with the bottom 30 feet below low tide. At the time of our visit in October, 1906, this was nearly finished, but an immense amount of excavating remained to be done to connect the dock with the harbour. The dry dock has been built of concrete, a material that has entered largely into the construction of all new harbour works at both terminals.

At the western side of the harbour granitic cliffs form a bold promontory surmounted by a lighthouse, at the base of which the prevailing winds from the north have piled up the sand like great



FIGS. 3 AND 4.—SALINA CRUZ, OAXACA, MEXICO. CLIFFS OF MICROGRANITE BESIDE ENTRANCE TO HARBOUR; SHOWING PECULIAR DISINTEGRATION AND THE DRIFTS OF SAND. FROM PHOTOS MADE FOR THE AMERICAN MUSEUM OF NATURAL HISTORY BY E. O. HOVEY.

snow drifts. The drifts, however, are not permanent, and a visitor during the season when the south winds prevail would find the cliffs barren of the sand, which has been blown over the breakwater into the new harbour, rendering constant dredging necessary to maintain the works.

The natives inhabiting the Isthmian region belong to the Tehuana tribe of Indians, and are noted for their graceful figures and carriage, the intelligence, and even beauty, of their features, and the small size of their well-formed hands and feet. They still preserve many of their ancient customs and wear their picturesque costumes.

On festival occasions a girl's dowry is draped about her neck in the shape of five, ten, and twenty-dollar American gold-pieces linked together to form a necklace. Sometimes the value of these necklaces amounts to hundreds, and even thousands, of dollars, those belonging to one girl whose photograph we saw being worth not less than \$3,000 in currency.

Tehuantepec is the chief town of the Isthmus and of the Tehuana. It is a quaint, old city of some 5,000 inhabitants, clustering around a pretty plaza, one side of which is, of course, bounded by the market and its bazaars.

Aside from municipal buildings, there is scarcely a house in town more than one story in height, and the residence streets show the usual tropical characteristics of heavy-walled houses with strongly-barred windows and low, flat, tiled roofs. A short two-minutes' walk from the plaza brings one to the poorer quarters of the town, where one may see, among other things, the weaving of textiles going forward in primitive fashion, and the carding, spinning, dyeing and weaving of cotton goods, which are done now by hand and in the same manner as for generations. The Tehuana women are very fond of ornamenting their garments with machine embroidery in yellow and blue thread, and we found Singer sewing-machines, which they use for this purpose, in some most unexpected places. The Singer sewing-machine, indeed, is one of the most widely distributed of all American inventions. Modes of transportation throughout the region are still primitive, and at many places on the Isthmus we saw in use bullock carts of the heaviest and clumsiest construction.

Passing the geology of the region in rapid review, we have, according to Böse,* at Salina Cruz, ancient acid intrusive igneous rocks in the shape of granite in and to the east of the village itself; while microgranite forms the main portion of the precipitous and

* E. Böse, *loc. cit.*

forbidding ridges to the west along the coast. The belt of these rocks is about three miles wide. About ten miles north, across a stretch of alluvial and coastal plains, the railroad enters, at Tehuantepec, a zone of gneiss with associated felsite, intrusive granite and crystalline schists, but the pyroxenic gneiss predominates. This zone, which is about two miles wide, is considered to be of Archæan age. Much of the microgranite has been quarried for concrete work at Salina Cruz; while the felsite of Dani Lieza, near Tehuantepec, has furnished the great blocks of stone needed for the jetties. North of Tehuantepec the railroad traverses another sandy, alluvial (?) plain for 15 miles and then enters an area 2.5 miles across of muscovite granite and microgranite, in the midst of which is the village of San Jerónimo. Beyond San Jerónimo the road crosses the last bit of the coastal plain region of the Pacific, a sandy stretch of eight miles, and enters the zone about 22 miles wide of gneiss, crystalline schists, quartzites and phyllites, which forms the real Archæan backbone of the continent here. It is the heart of the Sierra. These crystalline rocks are associated with metamorphic limestone which is thought to be of Middle Cretaceous age, though exact determination is impossible through absence of fossils. The gneiss and crystalline schists are much folded and contorted and the limestone has been folded and faulted.

Beyond the zone of gneiss, and separated therefrom by a ridge of heavy-bedded crystalline limestone, is a broad zone (32 miles) of much-contorted argillaceous schists and sandstones which are referred with probability to Lower Cretaceous age. Our section has now reached Paso de Buques (165 km. from Coatzacoalcos), a short distance beyond which there occurs a rather narrow belt of Middle Cretaceous limestone. From 162 km. to Chinameca (37 km. from Coatzacoalcos) there are occasional exposures of Upper Miocene beds of sand, clay, and gravel containing fossils. Several broad anticlinal and synclinal folds are indicated by the positions of the strata.

Near Aguas Medias, 97 km. from Coatzacoalcos, in the midst of this broad Tertiary plain, rise some low but precipitous mountains of massive limestone which is regarded as being of Cretaceous age. This has been quarried extensively for the jetties at Coatzacoalcos and for ballasting the railroad. From Chinameca to the Gulf there seem to be only sands of Pleistocene or modern age, the latter being probably for the most part destroyed dunes. Extensive marshes border the Gulf.

CLIMATE AND BOUNDARIES OF VIRGINIA.

BY

G. T. SURFACE.

CLIMATE.

In speaking of the climate of any region we naturally think of the weather conditions which prevail during the different seasons. Temperature, pressure, humidity, absorption, radiation, winds, and currents are the determinant factors, all of which interact with infinite variations. Just as the chemist and physicist are unable to dissect and measure the smaller units of physical substances, so the climatologist is unable to measure the smaller units of climatic cause and control. We can, however, determine the larger units, and out of these construct logical groupings. These, when studied in relation to each other at regular intervals through a long period, indicate with a fair degree of accuracy what may be considered as *constants* and *variables*. It is thus that we arrive at the science of *climatology*. It is only within modern times that it has advanced to the stage of becoming really an economic science, which we are conservative in saying is but in its infancy.

The native wealth of any land area is determined largely by its climatic and geological environment. We are justified in affirming that Virginia holds an exceptionally favored position as to the harmony of these two wealth-determining factors, so that nothing is lacking, from the standpoint of natural essentials, for the largest and most economic development of its resources.

The effect of climatic influences on the social order is also not to be lost sight of, or underestimated. The leading psychologists and anthropologists attribute the wide differentiation of races to differences of geographic environment. Many of these designate climate as the controlling factor. Whether this may, or may not be true, we do know that climatic extremes do not conduce to the most efficient voluntary activity.

The climatic belts of the State are in general coincident with the physical divisions. There are limited areas, which, by virtue of their position, are subject to more sudden changes and greater extremes.

There are no high mountain ranges in the State, but the elevation is continuous from the Eastern Shore to the Blue Ridge. We see in Table I (p. 97) a difference of 10° in the mean annual temperature

of Norfolk and Burke's Garden, the latter being an observation station in Tazewell County. This difference would be even greater but for the tempering effect of the warm waters of the Gulf of Mexico on the prevailing southwestern winds. The rainfall varies somewhat with the seasons, but the general average for different years shows that no section can be said to be favoured above another. This average ranges between 35 and 45 inches. The rainfall of the Tidewater region would be considerably heavier than in the Blue Ridge, the Valley, and the Appalachia regions but for the re-saturation of the southwestern winds as they pass over the warm Gulf waters. Killing droughts and disastrous weather changes, such as are common to the region west of the Mississippi River, are unknown. In Texas we find a maximum difference in the mean annual temperature of 21.7° , and droughts are not infrequent in the northern and western portions of the State. Washington shows the widest range in the annual rainfall, Clearwater having an average of 126 inches and Mottinger Ranch an average of 11 inches.

The Alleghany Highlands, extending for a distance of 200 to 500 miles west of the State boundary, constitute an effectual barrier against the storms which originate in the Mississippi Valley region.

The mean average annual temperature for the whole State is about 56° .

Tidewater.—The climate of this coastal region has a mean annual temperature of 58° to 61° , being greatly ameliorated by the warm north-west currents of the Atlantic, whose waters intermingle off the Florida coast with the heated waters of the Gulf Stream as they emerge from the Gulf of Mexico, and flow thereafter as a north-east current along the eastern coast of the United States. The soil of this belt is universally sandy or a sandy loam and, with a limited rainfall, or cold climate, would be of little economic value. Having an adequate rainfall and a warm-temperate climate, it becomes ideally adapted to the profitable industry of trucking, and holds first rank in this line of production. Much of the arid land of the west has a similar soil, and as favourable temperature requirements, but is practically worthless for lack of rain supply or irrigating facilities.

The average growing season* is from 7 to $7\frac{1}{2}$ months' duration. The winters are short and mild; the snowfall usually light; and the freezing never extreme or protracted. The summer's heat is so tempered by the sea-breezes as to seldom become oppressive.

Malaria was common during the early Colonial days, but this has been largely exterminated by clearing the forests, draining the low-

* Average duration from the last killing frost in the spring to the first killing frost of autumn.

lands and swamps, and the removal of the residences to more sanitary locations.

The mean annual temperature of the extreme southern Tidewater Counties averages about 60° . It is in this belt that cotton is grown to a limited extent. The mean annual temperature decreases gradually within narrow limits as we pass northward. This results both from the more inland geographic position, and the difference in latitude. The heaviest rainfall registered in Tidewater is in the Richmond, Williamsburg, Pamunkey and Gloucester Peninsulas, this belt being northwest of the Chesapeake Bay mouth. Even in the Virginia coast region there is considerable seasonal variation in the amount of precipitation.

Middle-Piedmont.—The average mean annual temperature of this belt is 56° - 58° . Lynchburg is near the Middle-Piedmont boundary line, and Manassas is on the line. In 1900, the average for Lynchburg was 58.4° , and for Manassas 56.5° (in 1902 the average for Lynchburg was 56.8° , and for Manassas 54.1°). This climatic belt marks the area of the most successful tobacco culture. Tobacco is also cultivated with fair success in the mountain areas, with a mean annual temperature as low as 52 degrees.

The growing season of the Piedmont belt is 2 to 3 weeks shorter than in Tidewater.

There is greater variation in the prevailing direction of winds in this belt than exists in any other part of the State, because of its inland location with reference to both the mountains and the sea. The autumn winds are prevailingly northwest, but those of the other seasons fluctuate, the east and north east being most common in the spring and summer. The northwest autumn winds are usually displaced by western winds in the early winter, which in turn give way to southwest winds before March.

Blue Ridge, Valley and Appalachia.—These regions constitute the mountain district of the State, in which the climatic differences so far as revealed by observation do not justify a differentiation. The mean annual temperature of the Blue Ridge and the Valley is 52° - 56° , and that of Appalachia is 48° - 54° . We may correctly designate this as the zone of grasses, grains, and apples. The average mean annual temperature not only increases as we pass from east to west, but also from north to south, since the elevation gradually increases from the Potomac River southward.

The aggregate precipitation of the mountain district does not differ materially from the Piedmont-Middle belt, but the proportion represented by snow is much greater; and the rains are more frequent

and of shorter duration. The rainfall also increases with the altitude up to a variable limit, which is fixed by the local conditions. The mountains not only cause the condensation of the vapour brought by the rain-bearing winds, but prevent this supply of moisture from being carried away again by the winds in dry, clear weather. The rainfall of the Valley is greatest along the base of the mountains, since the air, approaching the mountain, is forced to rise some distance from the barrier. Most of the rain is supplied by the south-east and southwest winds, the one directly off the warm Atlantic and the other less directly off the warmer Gulf. Those from the Gulf have been robbed of some of their moisture by the intervening land areas, but the increased elevation enables them to draw more effectively from the decreased supply. Equalization of distribution is established by the eastern half of the State having the advantage of ocean proximity, and the western half the greater elevation.

The duration of the growing season is $5\frac{1}{2}$ to 6 months in the Blue Ridge and Valley, and an average of 2 weeks less in the Appalachia country.

This region, together with the part of Piedmont adjacent to the Blue Ridge, is peculiarly adapted to apple culture. The most successful growers plant their orchards on the mountains, because the valleys are not only more subject to frost, but the winter temperature is lower than for the mountain, up to a greater elevation than is represented by the mountains of Virginia. It is for this same reason that the coffee plantations of Brazil are laid out on the high ground. This theory when first advocated was considered absurd. It is now no longer accepted as a theory but as a fact, having been demonstrated by the scientists of America and Europe. The explanatory cause is, the greater radiation in the valley. This is not necessarily more rapid, but of longer duration. It begins one to two hours earlier in the evening, and continues one to two hours later in the morning. The following we quote from Julius Hann:^{*}

The Swiss have learned by experience that the mountain sides have far more favourable temperature conditions in late autumn and in winter than the lowlands. During one of the calm, clear spells of late autumn the traveller who spends a few days at one of these farm houses on the steep mountain side may there breathe air which has the mildness of summer; he may see the green fields still decked with autumn flowers . . . while down below, in the valley, the ground is already frozen hard by the frost, the trees are lifeless, and all the activities of plant life have long ceased.

There is a wide variation in the snowfall of the State, both regionally and seasonally. It is usually light and of short duration in Tidewater and Middle Virginia. From the Blue Ridge westward, however, it is not uncommon for the ground to be blanketed a period

* Handbook of Climatology (Ward's translation), p. 264.

of six weeks or two months. This is of great economic value to the grain and grass crops of the region, protecting them not only against the intense cold of January and February, but ameliorating the effect of the thaws of occasional warm days. Since the region under discussion includes most of the large forested areas of the State it is important that we make a brief study of the climatic effects of forests. Forests increase the absorption, and protect the contained moisture from speedy evaporation. This is most in evidence during a drought. When the fields are parched and dusty, scarcely showing signs of life, the adjacent forest has a wealth of foliage and flower. Throughout the areas that have been deforested during the last half century there is a noticeable decrease in the size of the streams. The ruins of old mills still remain on streams whose volume would now be entirely inadequate. The influence of forests on the distribution of water supply is greatest in connection with the snows and rains of the winter season. By preventing the snows from drifting and decreasing the melting, a forested area thereby holds the water until it can be assimilated by percolation and absorption. We do not insist that the aggregate rainfall has been materially lessened, but that the same rainfall in a deforested region cannot be so thoroughly assimilated. If the country is deforested the ground usually freezes several inches before it receives much snowfall, and, in consequence, remains frozen to a greater or less extent until the approach of spring. The frozen earth being almost impervious, causes the loss of most of the water by surface drainage. The natural result is that floods are far more frequent in deforested regions.

Forest soils have also that constituency and protection which appreciably decreases radiation. The old settlers recognized them as "warm soils," without having the knowledge of a scientific explanation. The inability to raise peaches in certain parts of Michigan with former success has been ascribed by some students of the question to the deforestation of the country.

GENERAL REMARKS.

The climate of Virginia is ideally adapted to successful agriculture, since the prevailing conditions in the different geographic divisions are such as are best suited to the soils of those regions. If the Blue Ridge and Tidewater could exchange positions, Virginia would cease to supply the eastern markets with early vegetables, and, instead of an annual surplus of more than \$10,000,000, would be but little more than self-supporting. Then, if Appalachia could ex-

TABLE I
Norfolk
Richmond
Farmville
Lynchburg
Staunton
Clifton
Blacksburg
Manassas
Burkes G
Bigstone.
TABLE II
Norfolk
Richmond
Farmville
Lynchburg
Staunton
Charlotte
Blacksburg
Wytheville
Burkes Ga
Bigstone G
TABLE III
Norfolk
Richmond
Farmville
Lynchburg
Staunton
Clifton
For
Blacksburg
Manassas
Burkes Ga
Bigstone G

change places with Piedmont, Virginia would cease to be an important tobacco-producing State, and the net receipts from this resource alone would be decreased by at least \$5,000,000 per year. The rainfall has the most advantageous monthly distribution with reference to farming operations and the growth of crops, being somewhat heavier from April to July, which makes disastrous droughts unknown. The growing season of each section is always long enough to mature the standard crops of that section.

In general healthfulness, probably no State in the Union is more favored. The coastal region is growing in importance as a winter resort, and the western part of the State has for many years been a Mecca for summer tourists who seek health and comfort. The popular resorts are to be found in almost every county west of the Blue Ridge.

MEAN ANNUAL TEMPERATURE, RAINFALL AND SNOWFALL, AND LENGTH OF GROWING SEASON,
1900-1905.

FOR REPRESENTATIVE VIRGINIA STATIONS.

STATION.	NAT. DIV.*					ANNUAL		KILLING FROST		ANNUAL	
		JAN.	APR.	JUL.	OCT.	MEAN	EXTREME MAX. MIN.	LAST IN SPRING	FIRST IN AUTUMN	RAINF. INCHES.	SNOWFL. INCHES.
TABLE I, 1900:											
Norfolk.....	T	42.4	45.5	80.9	65.8	60.7	100.13	Mch. 22	Nov. 10	39.34	7.3
Richmond.....	P-T	39.4	57.3	81.2	64.6	59.7	102.10	Apr. 5	Nov. 10	37.76	15.1
Farmville.....	P	57.6	80.6	64.4				Apr. 14	Nov. 6	9.	
Lynchburg.....	P	37.6	57.1	78.6	63.3	58.4	100.9	Mch. 22	Nov. 10	47.10	7.2
Staunton.....	V	37.4	54.3	77.1	61.1	56.0	102.2	May 10	Nov. 9	39.02	
Clifton Forge.....	A	31.8	50.5	74.6	63.1	55.1	100.6	Apr. 15	Nov. 6	37.91	
Blacksburg.....	V	35.7	51.2	71.4	57.3	52.0	96.2	May 10	Oct. 18	43.75	20.5
Manassas.....	P	35.0	53.6	78.8	60.7	56.5	99.2	Apr. 15	Nov. 9	31.07	4.5
Burkes Garden.....	A	31.3	48.9	67.9	54.0	50.1	89.6	May 5	Oct. 10	41.85	38.0
Bigstone.....	A	35.2	55.4	75.2	63.4	56.3	95.4	May 11	Nov. 5	48.9	20.5
TABLE II, 1901:											
Norfolk.....	T	41.9	52.0	81.0	61.0	58.5	100.16	Mch. 8	Nov. 11	42.61	11.5
Richmond.....	P-T	38.8	52.8	81.0	59.1	59.2	99.9	Mch. 17	Nov. 6	42.05	15.8
Farmville.....	P	39.0	53.6	82.2	57.4			Mch. 30	Oct. 26	11.0	
Lynchburg.....	P	38.3	51.9	80.0	57.0	55.7	97.8	Mch. 18	Oct. 26	54.81	10.3
Staunton.....	V	37.6	50.0	78.2	56.8	54.1	96.1	Apr. 12	Oct. 30	51.18	
Charlottesville.....	P	37.8	51.8	79.0	59.4	55.4	97.7	Mch. 12	Oct. 12	65.29	15.5
Blacksburg.....	V	33.0	45.2	74.0	52.0	50.0	92.0	Apr. 12	Oct. 4	53.46	20.3
Wytheville.....	V	35.1	47.0	75.4	54.7	52.2	95.0	Apr. 12	Oct. 8	62.65	
Burkes Garden.....	A	31.8	42.4	70.4	48.4	47.6	88.-14	Apr. 29	Sept. 21	63.71	
Bigstone Gap...	A	35.4	49.0	76.5	54.9	53.3	95.-5	Apr. 24	Oct. 4	55.77	28.8
TABLE III, 1902:											
Norfolk.....	T	37.4	56.0	79.6	64.2	59.3	98.18	Mch. 19	Dec. 6	38.4	0.1
Richmond.....	P-T	36.2	55.8	79.0	61.6	58.2	98.15	Mch. 7	Oct. 30	49.32	2.2
Farmville.....	P	33.6	54.8	80.7	59.6			Mch. 21	Oct. 22		
Lynchburg.....	P	34.3	54.8	78.5	59.0	56.8	99.13	Oct. 30	48.79	2.1	
Staunton.....	V	33.8	52.4	76.3	58.4	54.9	99.9	Apr. 16	Oct. 15	38.19	
Clifton Forge.....	A	28.0	47.7					Apr. 20			
Blacksburg.....	V	30.5	49.0	72.5	55.1	52.4	95.5	Apr. 18	Sept. 14	33.73	6.
Manassas.....	P	33.5	50.0	77.8	58.6	54.1	103.0	Apr. 20	Oct. 22	36.85	
Burkes Garden.....	A	29.0	44.7	67.6	50.7	48.5	87.0	Apr. 18	Sept. 14	43.95	11.0
Bigstone Gap...	A	33.4	54.2	74.2	57.0	55.1	94.6	Apr. 13	Oct. 15	48.66	

* Tidewater (T), Piedmont (P), Valley (V), and Appalachia (A).

Climate and Boundaries of Virginia.

MEAN ANNUAL TEMPERATURE, ETC.—Continued.

STATION,	NAT. DIV.*	ANNUAL					KILLING FROST		ANNUAL			
		JAN.	APR.	JUL.	OCT.	MEAN.	EXTREME MAX.	MIN.	LAST IN SPRING.	FIRST IN AUTUMN.	RAINF., INCHES.	SNOWFL., INCHES.
TABLE IV, 1903:												
Norfolk.....	T	41.2	58.0	78.7	60.6	59.0	97	14	Apr. 5	Oct. 28	46.10	15.3
Richmond.....	P-T	38.2	57.8	79.3	58.9	93	7		Apr. 24		47.43	20.4
Farmville.....	P	38.2	55.4	78.0	57.8	99	12		May 3	Oct. 26		
Lynchburg.....	P	36.6	56.1	77.6	58.0	56.4	96	8	Apr. 5	Oct. 24	41.24	14.6
Staunton.....	V	34.6	54.5	74.2	57.1	54.4	95	-5	May 2	Oct. 25	45.63	
Rocky Mount.....	P	33.4	52.6	71.2	53.2	89	7		Apr. 6	Oct. 27	49.61	
Blacksburg.....	V	32.5	50.5	71.8	52.3	53.2	91	-1	May 2	Sept. 29	44.76	20.0
Burkes Garden.....	A	29.7	47.2	66.8	48.8	48.1	86	-6	May 5	Sept. 19	46.22	28.0
Manassas.....	P	33.0	53.1	75.8	56.6	56.6	96	2	Apr. 6	Oct. 27		
Williamsburg.....	T	35.8	56.2	78.0	57.8	56.9	98	9	Mch. 4	Oct. 27	49.24	
Bigstone Gap....	A	39.0	54.3	74.0	55.2	55.1	94	-3	Apr. 24	Oct. 19	46.8	20.9
TABLE V, 1904:												
Norfolk.....	T	36.4	55.4	77.3	59.6	57.4	94	12	Mch. 29	Nov. 7	42.6	12.3
Richmond.....	P-T	33.4	54.2	77.7	57.7	56.2	98	9	Apr. 20	Oct. 28	37.84	19.0
Farmville.....	P	32.8	52.8	78.0					Apr. 21			
Lynchburg.....	P	32.8	52.2	75.6	56.2	54.8	98	3	Apr. 22	Oct. 4	26.87	19.2
Staunton.....	V	30.3	50.0	72.5	55.7	59.9	95	-4	Apr. 22	Oct. 7	28.84	
Wytheville.....	V	28.8	46.5	69.4	51.8	50.7	89	3	Apr. 22	Oct. 15	24.28	19.9
Blacksburg.....	V	29.	46.6	69.4	54.4	50.3	91	-3	May 16	Oct. 15	32.25	26.0
Charlottesville.....	P	31.8	52.8	75.1	58.6	55.3	90	4	Apr. 22	Oct. 7	30.37	21.0
Burkes Garden.....	A	26.2	44.1	64.4					May 11	Sept. 16	39.59	29.0
Bigstone Gap....	A	32.5	51.1	71.8	55.3	54.3	92	5	May 17	Oct. 24	39.06	30.2

* Tidewater (T), Piedmont (P), Valley (V), and Appalachia (A).

GEOGRAPHIC AND POLITICAL BOUNDARIES.

Five natural geographic divisions can be easily recognized in a study of the physical features and climatic belts of the State. These have a general northeast and southwest direction, as fixed by the Atlantic coast-line on the east, and the Appalachian System on the west.

NATURAL DIVISIONS.

	AREA IN SQUARE MILES.
1. Tidewater	11,000
{ 2. Middle	12,000
3. Piedmont	6,000
4. Blue Ridge.....	2,500
5. Valley	5,000
6. Appalachia	5,400

These divisions succeed each other in parallel order, and are characterized by a continuous increase of elevation from the sea westward.

Tidewater.—As the name would indicate, this represents that portion of Virginia territory which constitutes a part of the Coastal

Plain. It is an irregular quadrilateral in shape, averaging 114 miles in length from north to south, and 90 miles in width from east to west, and includes an area of about 11,000 square miles. On the south it borders North Carolina for a distance of 104 miles; on the east it is bounded by 1,500 miles of tidal shore-line on the Atlantic Ocean, Chesapeake Bay, and the Lower Potomac River, or one mile of shore to every $71 \frac{1}{3}$ square miles of territory. The continent of Europe has one mile of shore-line to every 191 square miles. The western boundary is marked by that line of sudden topographic change known as the *fall line*, where the streams emerge from the hard crystalline rocks of Piedmont on to the soft sedimentary deposits of the Coastal Plain. The great number of bays and estuaries are of comparatively recent origin, having been formed by the gradual subsidence of the Coastal Plain region.

The political boundary lines of Virginia are generally irregular, but they are more irregular in Tidewater than elsewhere, since the boundaries of the older counties were almost without exception fixed by the streams and the Chesapeake Bay water front.

Middle Virginia.—In the article on physiography this territory was grouped as a part of Piedmont because of the similarity of structure and the inability to so clearly differentiate it physiographically from the Piedmont proper. However, in the early development of the country the barriers which constitute its irregular western border were sufficient to give rise to a fairly well-defined differentiation of population. It is for this reason that we describe it here as a geographic division.

It extends westward from the head of tide ("fall line") to the foot of the low, broken ranges, Catoctin, Bull Run, Yew, Clark's, South-west, Carter's, Green, Findlay's, Buffalo, Chandler's, Smith's, etc., mountains and hills. These extend across the State in a southwest direction from the Potomac River, near the corner of Fairfax County, to the North Carolina line, and are a part of the eastern outliers of the Appalachian System. The general form of this area is that of a right-angled triangle, its base resting on the North Carolina line; its perpendicular a line 174 miles in length, extending from the North Carolina line to the Potomac River; and the hypotenuse, 216 miles in length, extending along the Piedmont border. Most of the streams cross it at right angles, dividing it into a series of ridges. On the whole, it has the appearance of an undulating plain. A triangular area, including a part of Fauquier, Fairfax, Culpepper, and Madison counties, consists of Triassic-Jurassic sandstone, which produces a residual soil of marked fertility and durability.

Piedmont.—This division extends from the Appalachian outliers, previously named as the irregular western border of Middle Virginia, to the eastern base of the Blue Ridge. It varies in width from 20 to 30 miles, and extends from the banks of the Potomac to the banks of the Dan River on the North Carolina line, a distance of 244 miles. The elevation increases from 300-500 feet on the east, to 700-1200 feet along the Blue Ridge border. The topography is much broken by the numerous streams which cross it almost at right angles.

From the middle of the 17th Century to the middle of the 18th Century this region constituted the Virginia frontier, which gave rise to a very distinct type of society.

Blue Ridge.—This is the most prominent physical feature in the State, and stands as a conspicuous barrier between the Piedmont and Valley regions. It is 3 to 20 miles in width. Its elevation at Harper's Ferry, where the Potomac breaks through the Ridge, is 1,460 feet. This increases southwestward, reaching its maximum in Rogers Mountain, Grayson County, which is 5,719 feet in elevation. In its southern portion it expands into a plateau, which is the watershed for the waters which flow into the Gulf of Mexico and the Atlantic Ocean. This fan-like expansion includes the counties of Floyd, Carroll, Grayson, and parts of Franklin and Montgomery.

The early colonists gave it the name of the "Blue Mountain," or the Blue Ridge, from its appearance in the distance. During the first half century of colonization the inhabitants believed it was impassable; and the first explorers to ascend it did so only to find other heights as formidable in appearance looming up in the west, and turned back in discouragement. In the spring of 1669 John Lederer* made a trip to the top of the Blue Ridge, which he called *Apalataei*. Almost the whole of the plateau is drained by New River, which flows northeast through a gorge valley of circuitous winding, having established its course at a stage of advanced erosion, when the whole Appalachian area was reduced to a peneplain.

The Valley.—This division is 15 to 30 miles in width and 310 miles in length, making an area of about 5,000 square miles. It consists of a continuous chain of counties, the boundary of which is fixed by the Blue Ridge on the one side and the second and third range west of the valley on the other. Prior to 1738 all that part of Virginia situated west of the Blue Ridge was included in the County of Orange, but in the fall of 1738 this territory was divided into the counties of Frederick and Augusta.

* Discoveries of John Lederer in Three Marches from Virginia, p. 11.

Appalachia.—This is the most irregular of the natural divisions both in boundary and physical features. The eastern boundary is in general formed by Walker, Brush, and North Mountains; while the western is formed by the Cumberland, Black and Flat Top Mountains south of the New River divide, and by the Alleghany Mountains or the Alleghany Front north of the divide.

This irregular belt is 260 miles in length and 10 to 50 miles in width, with an approximate area of 5,725 square miles.

The counties can be provisionally grouped with reference to their drainage system as follows:

1. *James River Group*, including Highland, Bath, Alleghany and Craig Counties.
2. *Kanawha or New River Group*, including Giles and Bland Counties.
3. *Tennessee River Group*, including Tazewell, Russell, Lee and Scott Counties.
4. *Sandy River Group*, including Buchanan and Wise Counties, which topographically belong to the Alleghany Plateau region.

SUMMARY OF STATE BOUNDARIES UNDER DIFFERENT CHARTERS AND NEGOTIATIONS.

- 1606.—First Charter* under James I, including all territory 100 miles from the coast, between 34° - 45° N. Latitude, and all the islands adjacent thereto.
- 1609.—Second Charter, known as "Virginia Charter of 1609," including 200 miles along the seacoast northward and southward "from the said point of Cape Comfort," "through from sea to sea," and all islands adjacent thereto.
- 1611-1612.—Third Virginia Charter, including all territory between 30° - 41° North Latitude.
- 1632.—Maryland is detached, but the separation is strenuously opposed by the Virginia colonists.
- 1744.—Virginia obtained from the Six Nations a deed for all their territory, which had for its boundary on the west and northwest the Mississippi and Illinois Rivers; thence along the east side of Lake Michigan, including Lake Huron; thence to the Ottawa River, which it followed to its junction with the St. Lawrence River; thence to the head of Lake Champlain; thence on the 45th parallel to the St. Lawrence River; thence to Lake Ontario; thence with the Lake shore to the western Pennsylvania boundary."†

* Jamestown was settled under this charter.

† Colonial Boundaries of Virginia and Maryland, Gilbert Thompson, pp. 8-9.

From this time the boundaries remained unchanged until the settlement of the national boundaries by the cession of 1783, in which, on October 20, the General Assembly passed an act authorizing the delegates in Congress to convey to the United States all the Territory northwest of the Ohio River*

1862-3.—The territory now constituting the State of West Virginia† was by the vote of the people separated from Virginia. It consisted of the three Northwestern Virginia Senatorial Districts.

THE KINGSTON EARTHQUAKE.

On the afternoon of January 14 Kingston, the capital of Jamaica, a city of about 80,000 inhabitants, was practically destroyed by earthquake and fire. The deaths number over 1,000. There were about 10,000 houses in the city and parish of Kingston, of which about 96 per cent. were wholly or partly of brick. Not one hundred of these buildings was in a habitable condition after the calamity. The comparatively few wooden bridges were mostly mere huts and were not badly injured. The first shock came at 3.30 P.M., and continued only about thirty seconds. Fire followed immediately, and in a few hours the destruction was complete. Within the first week after the calamity about fifteen severe shocks occurred. As the cable lines were damaged the news could not be sent to America and England for about a day. Only about a fourth of the population, mostly the very poor, remained in the city, camping on the race-course, in the parks, and in other open spaces.

Kingston was close to the seismic focus. The motion for a little over thirty seconds is described as like that felt on a ship in a choppy sea. The movement was chiefly vertical. Objects are described as jumping from the ground, which, if true, shows how violent was the shock. The rails of the street-car routes were twisted, water-supply pipes were damaged, and the sinking of the shore-line showed that the superficial beds, at any rate, underwent important changes of level.

Port Royal, six miles to the south, shared to a great extent in

* American History Leaflet No. 22. By Hart and Channing. p. 12.

† Constitution framed November, 1861—February, 1862, and ratified by the popular vote in April, 1862. Bill for the admission of the state passed the United States Senate July 14, 1862. State formally inaugurated June 20, 1863.

The Rending of Virginia. G. D. Hall. pp. 26-27.

the ruin, but outside a radius of ten to twelve miles from Kingston the loss to property is small. That, in its initial power, the earthquake was inferior to those of Valparaiso and San Francisco is clear from the smallness of the region that was severely disturbed, and also from the comparatively slight disturbances recorded at Shide, Edinburgh, and other far-distant seismic observatories.

Mr. Charles Davison, formerly Secretary of the British Association's Earth Tremors Committee, calls attention in the *London Times* (weekly edition, January 25, 1907) to the fact that the foundation of Kingston consists of beds of sand and gravel, brought down from the northern mountains. It is on ground of this kind that earthquake shocks attain their maximum intensity. At Charleston in 1886, and at San Francisco last year, the greatest damage was done on made land filling up old creeks or low-lying ground. During the Tokio earthquake of 1894 the range and intensity of the disturbance, as measured from seismographic records, were about twice as great on low, soft ground as on the hard chalk rock in the higher part of the city. Mr. Davison adds:

Almost the whole boundary of the Caribbean Sea is a band in intermittent motion . . . Jamaica is situated in the very position in which great earthquakes are to be expected, in which the ocean-bed shelves with great rapidity, not on one side alone, as in most earthquake-countries, but to the north even more steeply than to the south. San Francisco, Columbia, and Valparaiso are all situated on the margin of a great slope, while near the east coast of Japan lies one of the deepest regions of the globe.

He urges that, if Kingston is rebuilt on its present site, it may again be visited by great earthquakes, and that their effects will be all the more serious on account of the low-lying position of the town and the loose and friable nature of its foundation. There is no other harbour in the island to compare with the extensive haven between Kingston and Port Royal, and the new town will certainly not be far distant from its shores.

NAMES OF TOPOGRAPHIC FEATURES IN THE UNITED STATES.

The names applied to many of our most conspicuous geographical features, such as the Rocky Mountains, the Appalachians, and others, have not been used uniformly to cover exactly the same areas. Inexactness and confusion naturally resulted from the fact that there had been no authoritative decisions as to the extent of the regions to which these various names applied.

The United States Geographic Board, about the middle of last

year, sent a list of questions to many American geographers and geologists in the expectation that their advice would be of much value in deciding these problems of nomenclature. On February 6, the Board announced decisions with regard to twenty-two of these names and in nearly every case the decision was the result of a consensus of opinion among the persons consulted.

Following is the list of these decisions as sent to the Society by the Board. A few explanatory comments by the BULLETIN are printed under some of the decisions in smaller type:

CORDILLERAS.—The entire western mountain system of North America.

Some geographers have not favoured the use of any single name, while others have advocated "Western Highlands," etc.

ROCKY MOUNTAINS.—The ranges of Montana, Idaho, Wyoming Colorado, New Mexico, and western Texas.

This excludes the Wasatch and Uinta mountains of Utah which have often been referred to as part of the Rocky Mountains, but the majority of geographers agree that they may better be included among the Basin Ranges.

PLATEAU REGION.—The plateaus of the Colorado River and its branches, limited on the east by the Rocky Mountains, and on the west by the Wasatch Range, and extending from the south end of the Wasatch southwestward to Virgin River and down that river to its mouth; thence southeastward and eastward to the east boundary of Arizona, following the escarpment of the Colorado Plateau, and including on the north the Green River Basin.

BASIN RANGES.—All those lying between the Plateau Region on the east, the Sierra Nevada and Cascade Range on the west, and the Blue Mountains of Oregon on the north, including the Wasatch Range.

PACIFIC RANGES.—The Cascade Range, the Sierra Nevada, and the Coast Ranges collectively.

SIERRA NEVADA.—Limited on the north by the gap south of Lassen Peak, and on the south by Tehachipi Pass.

The Sierra Nevada has commonly been treated as extending practically to the northern boundary of California. This decision places the northern end of the Sierra Nevada about 120 miles further south and adds the mountains from Lassen Peak north to the Cascade Range. Geographers practically agree that structurally it is correct to place the north end of the Sierra Nevada at the gap south of Lassen Peak. Lassen Peak is the most southerly of the series of volcanic peaks which characterize the south part of the Cascade Range. The Atchison and Santa Fé R.R. passes through Tehachipi Pass, now fixed as the south end of the Sierra Nevada.

CASCADE RANGE—Limited on the south by the gap south of Lassen Peak, and extending northward into British Columbia.

COAST RANGES—Extend northward into Canada and southward into Lower California. They include everything west of Puget

Sound and the Willamette, Sacramento, and San Joaquin valleys, and southwest of the Mohave Desert.

There have been wide differences of opinion concerning the north end of the Coast Ranges, but most geographers agree in extending them over into Canada. They are low in Oregon and in southwest Washington. As to the south end of the Coast Ranges geographers seem to be generally agreed that the Ranges should include all those of southern California and down into the peninsula of Lower California.

The following nine decisions fix the extent of several ranges and groups of mountains under the names given:

BITTERROOT RANGE—Extends from Clarks Fork on the northwest to Monida, the crossing of the Oregon Short Line on the southeast, including all spurs.

MISSION RANGE—The range east and southeast of Flathead Lake, Montana.

The easternmost range which carries the Continental divide has recently been named the Lewis Range.

WASATCH RANGE—Includes on the north the Bear River Range, extending to the bend of Bear River at Soda Springs, Idaho, and on the south extending to the mouth of the San Pete River.

SAN JUAN MOUNTAINS—Include all the mountains of southwest Colorado south of Gunnison River, west of San Luis Valley, and east of the Rio Grande Southern Railroad.

SACRAMENTO—Includes those groups known as Jicarilla, Sierra Blanca, Sacramento, and Guadalupe.

SALMON RIVER MOUNTAINS—Include the group in central Idaho lying south of main Salmon River, west of Lemhi River, north of Snake River, and east of the valley of Weiser River.

BLUE MOUNTAINS—Include all the mountains of northeastern Oregon and extending into Washington to the bend of Snake River, with the exception of the Wallowa Mountains.

The Wallowa Mountains are separated from the Blue Mountains by a wide gap and apparently have no connection with them.

SANGRE DE CRISTO MOUNTAINS—The range extends from Poncha Pass, Colorado, to the neighborhood of Santa Fé, New Mexico, thus including the southern portion locally known as the Culebra Range.

FRONT RANGE—Includes on the north the Laramie Range as far as the crossing of the North Platte, and on the south includes the Pikes Peak Group.

There is a general agreement concerning both the north and south limits of the Front Range of Colorado. On the north, the Laramie is a direct continuation, although much lower. The range drops into a broken country east of South Park, and then rises again in the Pikes Peak Group.

APPALACHIAN MOUNTAINS—Includes all the eastern mountains of the United States from Alabama to northern Maine.

BLUE RIDGE—Includes the ridge extending from a few miles north of Harpers Ferry to northern Georgia.

APPALACHIAN PLATEAU—Includes the entire plateau forming the western member of the Appalachian Mountain System, known in the north as the Allegheny Plateau and in the south as the Cumberland Plateau.

The difficulty in using either "Cumberland" or "Alleghany" for the entire plateau is that the application of the word would be misleading. The name Appalachian Plateau is therefore adopted to include both parts.

OZARK PLATEAU—Is applied to the plateau in northwestern Arkansas and southern Missouri.

OUACHITA MOUNTAINS—Applied to the ridges of Western Arkansas south of the Arkansas River, Indian Territory, and Oklahoma.

No name has hitherto been applied generally to these crooked and broken ridges south of the Arkansas River and in the southern part of the Indian Territory.

GEOGRAPHICAL RECORD.

AFRICA.

THE CAPE TO CAIRO RAILWAY.—Sir Charles Metcalfe, in charge of the construction of the Cape to Cairo railway, who is temporarily in England, says that regular train service is now maintained between Cape Town and Broken Hill in northeast Rhodesia, 2,100 miles. New rolling stock worth \$750,000 has been ordered. The survey of the railway from Broken Hill to the Congo border at Bwana Mcubwa, 110 miles, has been completed, and the line will probably go northward to Constansie, a further distance of about 200 miles, thus traversing a large part of the Katanga mining region. The copper properties on the Congo frontier and at Constansie are being steadily developed and give signs of profit. The one bright spot in South Africa at present is South Rhodesia, where the farmers are doing well, a good deal of fresh ground has been put into grain and tobacco, and the increase of live stock has been very satisfactory.

PROGRESS OF THE PEOPLE OF UGANDA.—In their indigenous culture, and, still more, in their exceptional power of assimilating European civilization, the people of Uganda are unique in this part of Africa, and probably in the whole continent. When discovered by Europeans, they had a social system culminating in a king and an elaborate court, and comprising nobles, middle classes, and peasants. They built cities and constructed roads, two things which are conspicuously absent in other parts of East Africa. From the first their readiness to receive European instruction, both religious and other, was remarkable.

Though it is less than thirty years since the first missions were established in the country, nearly all the inhabitants are nominal Christians, and large numbers can read and write. A native parliament has been instituted, and native courts of justice. It is true that some of the laws are rather strange, and considerable discussion has been provoked by an enactment fixing the price of all wives at 13s. 4d., whatever their

b
a
se
do
re
se

the
tive
bla
Br

the
Ge
Te
Bu
du
tota
is a
pro
sum

\$7,
sam
abo
Uta
the
pro
Calif
Idah
in ac
oun
1904

M
No.
serva
to Ju
west
most
makin
Expl
Atlan

S
arriva
denti

beauty or mental accomplishments may be, but this people certainly offer the best augury that we have for the capacity of progress in African races. It remains to be seen whether they will advance beyond a certain point, and also whether their present docility will prove permanent, or whether, as among the Japanese, whom they resemble in some ways, the assimilative period will be followed by a revival of national sentiment.

The other Bantu-speaking tribes of the British East African territories are, with the exception of the Swahilis, of small importance. They have little in the way of native political and military organization, and only a moderate aptitude for adopting the blessings of European civilization.—(SIR CHARLES ELIOT, on "Native Races of the British East Africa Protectorate," *Proc. of the Roy. Inst. of Great Britain*, No. 99.)

AMERICA.

OUR PRODUCTION OF GOLD AND SILVER.—Mr. Waldemar Lindgren's report on the production of gold and silver in 1905 has just been published by the U. S. Geological Survey. The figures showing the approximate distribution by States and Territories are the result of conference between the Geological Survey and the Bureau of the Mint, and are accepted as final by the two bureaus. The total production of gold was 4,265,742 fine ounces, valued at \$88,180,700; the total production of silver was 56,101,600 fine ounces, valued at \$34,221,976, making an entire total value of \$122,402,676. The production of gold in the United States for 1905 is an increase of \$7,716,000 in value over that of 1904. The rapid advance in gold production, which began in 1892, but temporarily halted from 1901 to 1903, was resumed in 1904. This increase in 1904 over the output of 1903 was approximately \$7,000,000, and in all probability the increase in 1905 over 1904 will be at least the same amount. The chief sources of the great increase are as follows: Alaska added about \$6,000,000 to its output of \$9,160,458 in 1904, and Colorado, Nevada, and Utah added about \$1,000,000 each to their product of the previous year. On the other hand, decreases are noted in Arizona, Idaho, and other States. The States producing over \$1,000,000 in gold rank, at present, in the following order: Colorado, California, Alaska, South Dakota, Nevada, Utah, Montana, Arizona, Oregon, and Idaho. The production of silver in 1905 represents a decrease of 1,581,200 ounces in actual output, but in spite of this the increase in the average price of 4 cents an ounce (from 57 cents in 1904 to 61 cents in 1905) made an addition to the value in 1904 of \$765,952.

MAGNETIC OBSERVATIONS OF THE COAST AND GEODETIC SURVEY.—Appendix No. 3 of the *Report* of this Survey for 1906 contains the results of the magnetic observations made by the Survey under the direction of Dr. Bauer from July 1, 1905, to June 30, 1906. While the work of the year on land was principally in the States west of the Mississippi River and in the Hawaiian Islands, where magnetic data are most needed, it was distributed over 43 States and Territories. The policy of making magnetic observations at sea was continued, and the *Bache*, *Patterson*, and *Explorer* determined the three magnetic elements at 47 different points in the Atlantic Ocean, Gulf of Mexico, and Pacific Ocean.

ASIA.

SVEN HEDIN CROSSES TIBET.—News has been received from Sven Hedin of his arrival at Ngangon-tso in the southern part of Tibet. The brief message was evidently sent by carrier to the telegraph service of India. It announces that he has

crossed Tibet, from north to south, discovering many new rivers, lakes, and mountains. For eighty-four days he did not see a Tibetan. He found new goldfields, and his geographical and geodetic results were very important. The details of his latest journey will be awaited with much interest.

The few facts he has sent in advance of his own return show at least where he entered the country, and the wide field through which he has carried a series of new explorations. He approached the Tibetan plateau from Kashgar and entered Tibet at its northwest corner, the Aksai-shin or White Desert, practically a virgin field, for it has been known only along its edges. South of him was the broad belt in western Tibet, which had been revealed by the work of Dease, Bower, and Rawling, east of which is a wide zone that, though crossed by the tracks of Wellby, Bower, and Littledale, was still the largest unexplored area in Tibet. It is evidently in this white space, mainly between the meridians of eighty-two and eighty-six, in the southern part of which is the point from which he sent his despatch, that Sven Hedin has done his latest work.

He says that he lost his entire equipment, but saved his maps and other results of his explorations. He lost his equipment, also, in 1901, when he travelled in Tibet, far towards Lhasa. His camels could not live at a height of about 16,000 to 17,000 feet above the sea. If he took ponies with him on his recent journey, they could scarcely have fared better. In eight days Rawling's ponies, to the west of Sven Hedin's route, were reduced from 70 to 36; for, though it was June, the night temperatures were far below the freezing-point, and the animals could not endure the sudden transition from a temperate to an arctic climate.

Dr. Hedin says he has discovered new mountains. Every new route reveals them; and it is now evident that practically the whole surface of the plateau is covered with mountains and valleys, interspersed with many fresh and salt water lakes. He also found gold—another confirmation of the wide distribution of this metal on the plateau. Rawling says that the region to the west is rich in gold, and that miners go there from Lhasa to extract the metal.

LATEST ASCENTS OF DOCTOR AND MRS. WORKMAN.—Mrs. Fanny Bullock Workman has written four articles for the Allahabad *Pioneer*, describing the ascent of the Nun Kun Range in July and August last. Dr. Workman and his wife left Srinagar, Kashmir, on June 10, with Cyprien Savoye, one of the best of Alpine guides, six men from the Italian Alps, over 200 coolies, and a thorough equipment. The goal of the expedition was the Nun Kun Range, nearly 100 miles east of Srinagar. The range has three summits, each over 23,000 feet in height. A base camp was established at an altitude of 15,100 feet, and the start was made on July 25. Snow was reached at 16,500 feet. The first camp out was fixed at an altitude of 17,657 feet, and the second night was passed at 19,900 feet, where a glorious panorama was enjoyed. Two camps were occupied at successive altitudes of 20,632 and 21,300 feet. In these positions, which were much exposed, the most remarkable experience was the terrific power of the sun. At 2:30 in the afternoon the mercury reached 192° Fahrenheit, and by 4 it had declined to 142°; but on the sun disappearing at 7 P. M., ice formed at once, and by 9 the temperature had fallen to zero. In the final ascent Dr. Workman stopped at an altitude of 22,716 feet; but Mrs. Workman went on, accompanied by Cyprien Savoye and one porter, and reached the summit of Nun Kun at an altitude of 23,263 feet.

COMMERCIAL MISSION TO SOUTHEASTERN PERSIA.—The report of the British Indian Commercial Mission to southeastern Persia during 1904-1905 has been published at Calcutta. It is written by A. H. Gleadowe-Newcomen, President of the

Mission, and contains a large amount of geographical and economic information relating to southeastern Persia, and suggestions for the development of British trade. Southern Persia is a poor country, and the people, as a rule, are without initiative. Contrasting the Persian with the native of India, Mr. Gleadowe-Newcomen says:

The Persian differs widely from the native of India, who, whatever he may spend on occasions of rejoicing or of mourning, is, whether Hindu, Sikh, or Mussalman, a man of few wants, and frugal to a degree. The Persian is not a man of frugal mind. He resembles the European, and especially the Englishman, in his preference for putting the money he earns on his back or in his stomach, and rejoices in good food and good clothes. The humblest Persian dresses and eats well. Few men in rags are to be seen, except amongst the poorest peasants and the swollen ranks of the professional beggars. His demands are many and various, and he has a great craving for the luxurious and showy in every department of life. He himself dresses in sober colours, and his woman folk in the streets resemble sheeted ghosts. For the peculiar indoor dresses of his women and hangings for the adornment of his house he rejoices, however, in gay prints and cretonnes, bright-hued silks and rich satins. He is a great drinker of tea, which he makes and drinks in a manner peculiar to himself and the Russians, and his consumption of sugar, which he procures mostly from France, Russia, Austria, and Egypt, is enormous.

AUSTRALASIA.

CLIMATIC CHARTS OF NEW SOUTH WALES.—Mr. Henry A. Hunt, Acting Meteorologist of New South Wales, has published a series of ten climatic charts of New South Wales, showing the average seasonal and annual conditions over that colony. These charts measure 20 by 35 inches, and show the isobars, isotherms and prevailing winds, and the isohyetal lines, for spring, summer, autumn, winter, and for the year. The reproduction is by some sort of mimeograph or stencil process, but the lines and figures are distinct and satisfactory. It is to be hoped that some discussion of these charts will soon be forthcoming, and that they may be reproduced in more permanent form. Obviously, changes in the present location of many of the lines, as now drawn, will be necessary as newer observations are available.

R. DEC. W.

POLAR.

THE ANGLO-AMERICAN POLAR EXPEDITION.—The Society has received a letter from Captain O. C. Hamlet, of the U. S. steamer *Thetis*, giving the latest information concerning the Mikkelsen-Leffingwell party. The BULLETIN reported (October, 1906, p. 632) that on Sept. 4 the expedition was in Elson Bay, about 10 miles east of Point Barrow, waiting in its sailing vessel, the *Duchess of Bedford*, together with a whaling fleet of about a dozen vessels, for the ice to move off the coast sufficiently to allow a passage eastward. Captain Hamlet, who has returned with his vessel to California, writes that the ice finally broke up, and the master of the steam whaler *Belvedere* offered to tow the *Duchess of Bedford* into open water to the east. Captain Hamlet saw the master of the *Belvedere* at Dutch Harbor, Bering Sea, in October, who told him that he towed the exploring vessel through the ice all right, and that when the *Belvedere* turned back the expedition was sailing through open water with a free sheet to the eastward. Captain Hamlet expresses the opinion that the party is now at Herschel Island, near the Mackenzie delta, or that perhaps it has been so fortunate as to reach Banks Land, where Captain Mikkelsen, according to his original plan, hoped to spend the present winter.

AMUNDSEN'S NEXT PROJECT.—Although Captain Amundsen's observations in the neighbourhood of the magnetic north pole have not yet been worked out, he has already decided to go to the Antarctic to establish the present position of the magnetic south pole, which, according to present computations, is situated in about $73^{\circ} 39' S.$ and $146^{\circ} 15' E.$ The proposed undertaking will involve greater difficulties

than Amundsen encountered during his investigations near the magnetic north pole. He reached his northern field of work through waterways that are usually navigable every year, while the magnetic south pole is situated in the interior of Victoria Land, can be reached only by a long sledge journey over the inland ice, and the difficulties will be intensified by the prevailing unfavourable climatic conditions in the Antarctic, the frequent cyclonic snowstorms, and the complete lack in the interior of animal life with which to replenish food supplies. The work in the Antarctic will, therefore, require larger means of transportation and greater supplies of food than were necessary in the northern work.—(*Pet. Mitt.*, No. 12, 1906, pp. 288.)

VARIOUS.

A Russian expedition for the exploration of the Arctic regions is being equipped under the leadership of Lieutenant-Colonel Sergeyeff. The expedition, which will last for several years, will start from Yeniseisk and try to reach Bering Strait.

Prof. W. M. Davis has taken up again the series of "Current Notes on Physiography" in *Science*, with Prof. D. W. Johnson, of Harvard, and Mr. Isaiah Bowman, of Yale, as associates.

Dr. H. R. Mill has been elected an honorary member of the Vienna Geographical Society; and also president of the Royal Meteorological Society.

Prof. Frank H. Bigelow gave the first popular presentation of his theory of sunspot rhythm as related to weather rhythm, and of his new theory of the dynamics of the cyclone in two public addresses at the University of Chicago, Jan. 22 and 23, under the auspices of the Departments of Geography and Economics.

Dr. Franz Boas, of Columbia University, has been elected president of the American Anthropological Association.

Professor A. Lawrence Rotch of Harvard recently delivered a lecture on the "Exploration of the Atmosphere over Land and Sea" before the Canadian Institute at Toronto. Mr. Stupart, the director of the Canadian Meteorological Office, expects to establish a sub-station at Toronto, and may be able to carry out the wish of the International Committee for Scientific Aeronautics by creating stations for aerial soundings in Newfoundland and Bermuda.

NEW MEASUREMENTS OF SOLAR RADIATION.—In spite of the importance of continuous measurements of solar radiation, there have thus far been but few investigations along this line of research. The work of Crova and of Houdaille at Montpellier, and of Savelief at Kiev, has given an approximate knowledge of the solar climate of these two places. Careful absolute measurements of the intensity of solar radiation have also been made by Schukewitsch and Müller at Pawlowsk and at Katharinenburg, respectively. (See Hann's *Climatology*, Vol. I, English translation, pp. 108-110.) The latest contribution to this discussion is by Ladislas Gorczynski, entitled "Sur la Marche annuelle de l'Intensité du Rayonnement solaire à Varsovie et sur la Théorie des Appareils employés." This report of 202 quarto pages and charts is based on observations made at the central meteorological station at Warsaw during the period 1901-1905. It is published, in French, under the auspices of the *Bureau Central Météorologique* of Warsaw. The annual variation of solar radiation is shown by curves for each of the five years.

R. DEC. W.

The *Geographischer Anzeiger* announces in its December number that with the opening of its eighth volume in Jan., 1907, coloured and black-and-white maps and

pictures will be new features of the publication. Justus Perthes publishes this monthly, which is devoted to geographical education.

Dr. Frobenius, who recently returned from his ethnological studies in a part of the Kassai basin, has announced at a meeting of the Berlin Geographical Society that he will visit the Niger basin this year to continue his studies among the tribes of that region.

THE BOGOSLOV ISLANDS.—A COMMUNICATION FROM PROF. GEORGE DAVIDSON:
THE GEOGRAPHICAL SOCIETY OF THE PACIFIC

(Copy)

SAN FRANCISCO, February 3, 1907

To the Directors and Councillors *Geographic Society of the Pacific*,
San Francisco.

GENTLEMEN:—

In compiling a History of the group of Bogoslov Volcanic Islands in the Bering Sea, near Unalaska Island, I have been astonished at the number of names attributed to them individually; for example, Agashagok, Ionna Bogoslova, St. John Bogoslov, St. Jean Bogosloff, St. John Theologian, St. John the Divine, New Island, Krusenstern, Old Bogoslov, Bojoslov Volcano, Bogoslof, Bojoslov, New Bojoslov, Hague, Grewingk, Old Rock, New Rock, Fire Island, Castle Island, Perry Island.

Such a varied nomenclature is very unsatisfactory; the more especially as it has no regard to the epoch of each appearance, or the right of the Discoverer.

I therefore suggest for your consideration the following scheme of designation based upon the first European name, and the order of discovery:

Bogoslov I; (date 1795-96;
Bogoslov II; (date 1882-3;
Bogoslov III; (date 1906.

Very respectfully,

(Signed)

GEORGE DAVIDSON,
President.

The *Bollettino* of the Ministry of Foreign Affairs, Italy, publishes in its January number a paper (28 pp.) on the State of Oregon, by Dr. F. C. d'Olivola, Consular Agent of Italy, at Portland. It gives an excellent account of the geography, resources, communications, Italian colony, etc., of Oregon.

The *Mitteilungen aus den Deutschen Schutzgebieten* begins its 20th volume as a quarto. It has hitherto appeared as an octavo. It is also printed in larger type. No. 1 for this year is entirely given to a study of precipitation in German Southwest Africa by Dr. Emil Ottweiler, with a map in colours and many tables and diagrams.

The Geographical Society of Finland has dedicated Vol. 22 of *Fennia*, its valuable Bulletin, to the Secretary of the Society, Prof. Jean Axel Palmén, in recognition of his untiring activity in promoting the interests of the Society and in editing its publications since its organization in 1888.

VICE-PRESIDENT PETER DE SEMENOV, of the Imperial Russian Geographical Society, completed his eightieth year on the 15th of January, 1907. His friends in every land extend to him their warmest congratulations.

The annual dinner of the Geographical Society of Philadelphia was given at the Hotel Walton, Philadelphia, on the evening of January 25. About 300 of the members were present. Among the guests were Commander Peary and Mrs. Peary, Dr. Wilfred Grenfell, Professor William Libbey, and a number of other geographers and explorers.

The pipe-line conveying petroleum from Baku to the Black Sea has been completed. It is 550 miles long, and is capable of carrying 400,000,000 gallons of oil a year.

An oil pipe-line has been built to carry Texas and California petroleum across the Isthmus of Panama. It is 8 inches in diameter and 51 miles long.

Bendigo, one of the gold centres in Victoria, Australia, has just made a record for the greatest depth at which gold has been found. Gold ore was struck in driving a cross cut at 4,254 feet in the Victoria quartz mine. The previous record in depth was held by the New Chum mine at 4,226 feet.

The *Tropenflanzer* has completed ten years of publication. Prof. Dr. Wohltmann opens the new volume with an article showing how this periodical has grown from small beginnings to its present position of helpfulness in the cause of colonial development. The first volume contained 334 pp., and the last one 834 pp.

THE LÜBECK GEOGRAPHICAL SOCIETY celebrated its Twenty-fifth Anniversary on the 15th of February, by a special meeting, followed by a commemorative banquet.

Dr. Charles Doolittle Walcott, Director of the U. S. Geological Survey, was elected Secretary of the Smithsonian Institution at the annual meeting of its Board of Regents, held on January 23.

THE AMERICAN GEOGRAPHICAL SOCIETY.—On the 13th of February the Cullum Geographical Medal, awarded by the Council on the 15th of November, 1906, in recognition of his fifty years of exploration in Canada, was presented to Dr. Robert Bell, of Ottawa.

OBITUARY.

Professor Adam F. W. Paulsen, Director of the Danish Meteorological Institute, died at Copenhagen on Jan. 11, aged 74 years. He led two Danish expeditions to Greenland and Iceland for the purpose of studying the aurora borealis, these researches being among his most important scientific labours. He pointed out the intimate connection between the meteorological conditions of Greenland and Iceland, and those prevailing over Europe, and it was largely owing to his efforts that Iceland has at length been brought into telegraphic communication with Europe.

NEW MAPS.

AFRICA.

AFRICA.—*Anteil der Deutschen an der Afrikaforschung.* Scale, 1:50,000,000, or 946.9 statute miles to an inch. By Paul Langhans. *Deutsche Erde* (No. 6, 1906), Justus Perthes, Gotha, 1906.

Eight small maps of Africa, four of which show by tints the explored, the largely explored, and the unknown areas of Africa in 1825, 1850, 1875, and 1900; four others show the part which Germans had taken in this exploration at the same periods. Illustrates a paper by Friedrich Hahn.

MOROCCO.—*Esquisse Géologique du Haut Atlas Occidental.* Scale, 1:1,000,000, or 15.8 statute miles to an inch. By Louis Gentil. *Annales de Géographie*, No. 85. Armand Colin, Paris, 1906.

This is a black-and-white geological sketch of the western half of the High Atlas which Mr. Gentil traversed in his recent visit to Morocco. The map is based upon the published data of earlier explorers in that region and his own surveys. The areas of the sedimentary, eruptive, and metamorphic rocks are indicated.

SAHARA.—*De Tombouctou à Taodéni.* Scale, 1:2,000,000, or 31.56 statute miles to an inch. By Lieutenant Cortier. Masson & Co., Paris, 1906.

Lieutenant Cortier, between March and June last, led a company of Maharists from Timbuktu north to Taodéni, where he met a similar party from Algeria, the routes of the two parties thus making a complete crossing of the desert. Cortier's journey covered nearly six degrees of latitude. The map illustrates Cortier's article on the journey in *La Géographie* (Vol. xiv, No. 6). Fixed and moving dunes, rock outcrops, pasturages, wells, beds of former streams, etc., are shown.

SAHARA.—*Itinéraires au Sahara, 1905.* Scale, 1:1,000,000, or 15.8 statute miles to an inch. By Prof. E. F. Gautier. *Annales de Géographie*, No. 85, Armand Colin, Paris, 1907.

Professor Gautier has begun the publication in the *Annales* of a series of Saharan studies, based upon his work in the desert. This map illustrates the first article which is devoted to a number of the wadys, west and south of the Tuat oases. The map shows the wadys, the location of humid and dry alluvium and dunes, and tentative contours of level.

ANGLO-EGYPTIAN SUDAN.—*Bahr el Ghazal.* Scale, 1:1,000,000, or 15.8 statute miles to an inch. Topographic Section, General Staff, British War Office: Edward Stanford, London, 1906. (Price, 2s.)

A part of the map of Africa which the Topographic Section, General Staff of the British War Office, is producing on a scale of 1:1,000,000. The comparatively small amount of topographic relief in this region is shown in yellow, hydrography in blue, and nomenclature in black. Many elevations are given in feet, and the sheet contains a large amount of general information, such as cart roads, tracks, and other routes, mission stations, forts, wells, etc. The comparatively large scale, however, plainly reveals the large amount of research yet required to fill all the white spaces on this sheet.

SOUTHERN NIGERIA.—*Sketch Map to Illustrate a Paper on the Structure of Southern Nigeria.* By J. Parkinson. Scale, 1:5,000,000, or 78.9 statute miles to an inch. *The Geographical Journal*, Vol. 29, No. 1, London, 1907.

The geological information in the map is confined to a line marking the southern limit of the crystalline rocks in the parts of Southern Nigeria that have been studied. In the author's article he says that to understand the structure of Southern Nigeria, it is necessary to realize the position and extent of the old floor of crystalline rocks, now exposed at the surface. The members of the geological series found in Southern Nigeria are few, and of these the granites, gneisses, and schists are by far the oldest. Upon their worn and eroded surfaces the later sediments were lain down. The nature of these sediments depends on the distance they were deposited from this old land surface. The positions and magnitudes of crystalline rock greatly modified the form and extent of the subsequent foldings. To both of these factors the scenery is directly related.

The map shows the southern boundary of these old rocks, extending from Abeokuta eastward and a little south of 7° N. Lat., but near the Niger it turns north. To the east the map shows a large hiatus over the unexplored country, and the rocks have not been found again with certainty until near the Oban Hills near the Kamerun boundary.

EGYPT.—Egypt. Scale, 1:50,000, or 0.7 statute miles to an inch. Sheets: XXVI, XX-VII, XX-VIII, S.E.; XXI-V, XXI-VI, XXI-VII, S.E.; XXII-VI, XXII-VII, XXII-VIII, S.E.; XXIII-VI, XXIII-VII, S.E.; XXV-VII, XXV-VIII, S.E.; XXVI-VIII S.E.; XXVII-VIII S.E.; XXVIII-VIII S.E. Survey Department, Cairo, 1906.

These sheets are a part of the topographical map of Egypt which the Survey Department began to publish early last year. The large scale permits the introduction of minute detail. The hydrography, including the canals, is in blue, the names and all cultural features, except the canals, are black, and the desert areas white. The nomenclature is both in English and Arabic.

TURKEY-EGYPT.—The Turco-Egyptian Boundary as Demarcated in 1906. Scale, 1:1,250,000, or 19.7 statute miles to an inch. *The Geographical Journal*, Vol. 29, No. 1, London, 1907.

The map shows the new frontier as defined in the agreement of Oct. 1, 1906, based on the work of the Joint Commission appointed earlier in the year. The map is a reduction from that accompanying the agreement which was produced by the Survey Department, Cairo.

GERMAN SOUTHWEST AFRICA.—Niederschlags-Karte von Deutsch Südwestafrika. Scale, 1:3,000,000, or 47.34 statute miles to an inch. By Dr. Emil Ottweiler. *Mitt. aus den Deutsch. Schutzgeb.* Vol. 20, No. 1. Mittler und Sohn, Berlin, 1907.

An excellent rain map in 14 tints of yellow, green and blue, showing the average annual precipitation. The three base colours also illustrate botanical distribution in that region, the yellow tints coinciding with the sandy zone lying nearest to the coast, the greens occupying the region of steppe vegetation, and the blues the area of greatest tropical verdure.

MASHONALAND.—Sketch Map of Southeastern Rhodesia. Scale, 1:3,500,000, or 55.23 statute miles to an inch. By Vincent Dickins. *Geog. Jour.*, Jan., 1907, London.

Illustrates Mr. Dickins' journeys in southeastern Mashonaland in 1904, to ascertain the possibility of obtaining native labour for service in the Transvaal mines. His routes extended about 3,000 miles, and his map corrects many errors in the earlier maps of Rhodesia, especially with regard to drainage.

AMERICA.

U. S. HYDROGRAPHIC OFFICE CHARTS.

Pilot Chart of the North Atlantic Ocean, February, 1907.

On the reverse of the sheet appears an article by Lieut. John C. Soley, U. S. Navy (retired), on "The Gulf Stream in the Gulf of Mexico," with two charts showing the Gulf currents for February, March, and April, in 1905 and 1906, and forecasts of the currents for the same months in 1907. Besides the main current,

which is a distinct part of the Gulf Stream, there are two counter-currents: (1) the Cuban counter-current, originating in the Bahama Channel, passing westward to the north of Cuba, curving southeast at the western end of the island and continuing towards Jamaica, where it curves south and joins the main stream; (2) the western counter-current, beginning near Pensacola and moving as far west as Galveston, where it turns south, hugs the shore as far as Zerez Point, where it makes a sharp turn and joins the main current of the Gulf Stream. In the N. E. part of the Gulf, west of Florida, is a body of dead water called the Central Sea. It is circular, with a diameter of about 80 miles. Nearly all the drift from the rivers, and weeds and floating objects in the Gulf work into this centre and remain there for some time, as in the Sargasso Sea.

Pilot Chart of the North Pacific Ocean, March, 1907.

UNITED STATES.—Map Showing Condition of Astronomic Location and Primary Control to April 30, 1906. Scale, 280 miles to an inch. Bulletin 310, U. S. Geological Survey, Washington, D. C., 1907.

All the astronomical stations are shown in red. Areas, controlled by triangulation or traverse, are coloured buff.

UNITED STATES.—Lines of Equal Magnetic Declination and of Equal Annual Change in the United States for 1905. (Natural scale not given.) Coast and Geodetic Survey, Washington, D. C., 1906.

The chart is accompanied by a description from the pen of Dr. L. A. Bauer. The large number of reliable determinations of magnetic elements made by the Coast and Geodetic Survey in the past several years have now made it possible to construct new magnetic maps for our country with an accuracy not hitherto attainable. This is the first time an isogonic chart for the United States has been produced by using only data whose value is precisely known. This chart depends upon accurate observations at 3,500 points over the United States. A new feature is the extension of the isogonic lines over the oceanic areas embraced by the chart. The isogonic lines are broken in certain regions to indicate that there the observations were not sufficient to establish their precise course.

CALIFORNIA.—Map of the Colorado Desert. No scale. By G. W. James. Little, Brown & Co., Boston, 1906.

A black and-white sketch map showing the main routes taken by Mr. James through the part of the desert in southern California. It illustrates his work in two volumes, *The Wonders of the Colorado Desert*. The information is roughly laid down, but is important, as map and literary material relating to this desert have heretofore been scanty. The map shows roads, trails, waterways, winter streams, areas of heavy sand, and differentiates lakes and reservoirs that are constant from those which exist only a part of the year.

CANADA.—Map of Part of the Southwestern Coast of Hudson Bay from York Factory to Fort Severn. Scale, 16 statute miles to an inch. Surveyed by Owen O'Sullivan. Geological Survey of Canada, Ottawa, 1905. (Price 10 cents.)

A micrometer and compass survey of the coast, with letterpress indicating the nature of the coast lands. Between Nelson and Severn rivers mud flats and boulders looking seaward, and marshes, dunes, ponds, and muskeg, bordered by stunted evergreen trees, looking landward, make up the landscape.

CHILE.—Mapa de la Rejion Austral de Chile i de la República Arjentina. Scale, 1:1,000,000, or 15.8 statute miles to an inch. Oficina de Límites, Santiago, 1906.

This large map is one of the products of the demarcation of the Chile-Argentina frontier. It shows on a considerable scale lakes Viedma, Argentino, and others, and the large glaciers from which the lakes derive a large part of their water supply. The map illustrates the "Demarcación de la línea de frontera en la parte sur del Territorio," describing the work of the fifth Chilian Commission in that region.

CHILE.—Mapa Geográfico de la Puna de Atacama. Scale, 1:1,000,000, or 15.8 statute miles to an inch. Oficina de Límites, Santiago, 1906.

Illustrates "La Línea de Frontera en la Puna de Atacama," describing the work of delimiting the boundary between Chile and Argentina in that region. The map is also of economic and commercial importance, showing the railroads, wagon roads, paths, nitrate fields, and gold, silver, copper and manganese mining areas.

NEW YORK.—Road Map of the State of New York. Showing proposed System of improved Highways. Scale, 9 statute miles to an inch. Albany, N. Y., 1906.

The map accompanies the annual report of the State Engineer. It shows the roads which are to be improved under the \$50,000,000 bond issue, those whose improvement is suggested under the same bond issue, and those which were improved prior to this loan. Towns which have adopted the money system of maintaining their highways are designated.

PERU.—Mapa Hidrológico. No scale. *Boletín del Cuerpo de Ingenieros de Minas del Perú*, No. 45, Lima, 1906.

Shows the hydrographic conditions in the Department of Arequipa and the Province of Moquegua. The surface forms are indicated by washes, irrigable lands are shown, and also the approximate boundary between the zones of general rainfall and those of periodical and variable precipitation.

ASIA.

ARABIA.—Karte von Arabia Petraea (3 sheets). Scale, 1:300,000, or 4.73 statute miles to an inch. By Prof. Dr. Alois Musil. Alfred Hölder, Vienna, 1906.

This map surpasses any other of Arabia Petraea yet produced in the extent of its nomenclature and the delineation of hydrographic features and land forms. It is the work of Prof. Dr. Alois Musil, an Austrian, who made extensive and difficult route surveys through that region under the auspices of the Imperial Academy of Sciences, Vienna. He collected a large amount of cartographic material. The three sheets show the entire orographic and hydrographic development of the region, with hundreds of place-names, numerous determinations of elevations, and three profiles having from eight to ten fold exaggeration of the vertical scale. The amount of detail is great, such minor features as vineyards, mills, etc., being shown, as well as all more important information, such as towns, roads, railroads, and telegraph lines. This fine product should be in every library, and is indispensable to all students of this part of Asia.

CHINA.—Province of Chih-li. (Southern sheet.) Scale, 1:1,000,000, or 15.8 statute miles to an inch. Compiled in the Topographical Section, General Staff, British War Office. Edward Stanford, London, 1906. (Price, 2s.)

This map, compiled from all available information, is the most detailed map of southern Chih-li yet produced. It shows the province from Mongolia on the north

to the Hoang-ho on the south and from the Gulf of Chih-li on the east to Shan-si on the west. It is especially complete in its delineation of main cart roads, pack roads, railroads, in operation or projected, telegraph lines, place-names, and mission stations. A considerable number of elevations are given in feet, but few other topographic facts are laid down. The common roads are in red, hydrography and canals in blue, railroads and place-names in black. In the closer study of China, made necessary by the new era of development, the map of which this is a sheet will be of the greatest value.

CHINA.—Province of Ho-nan. Scale, 1:1,000,000, or 15.8 statute miles to an inch. Compiled in the Topographical Section, General Staff, British War Office. Edward Stanford, London, 1906. (Price, 2s. 6d.)

Another sheet on the same plan as the southern sheet, province of Chih li, described above.

JAPAN.—Map Showing the Distribution per 100 Square Ri of Stone Age Sites in Japan. No scale. *Transactions of the Asiatic Society of Japan*. Yokohama, Dec., 1906.

Accompanies a monograph by N. Gordon Munro on "Primitive Culture in Japan." Symbols show the density of distribution of sites; and colours show the elevation above sea-level at which they have been found.

AUSTRALIA.

QUEENSLAND.—Queensland. Scale, 1:2,534,400, or 40 statute miles to an inch. Survey Office, Department of Public Lands, Brisbane, 1906. (Price, 1s.)

This excellent black-and-white map is primarily a road map of the State of Queensland. Common roads, railway and telegraph lines are clearly laid down. The map also throws light on the grazing interests and shows the situation of the artesian bores and tanks made by the Government and of the pastoral stations.

EUROPE.

FINLAND.—Geologisk översiktskarta öfver Sydöstra Finland. Scale, 1:1,000,000, or 15.8 statute miles to an inch. By Benjamin Frosterus. *Fennia*, Vol. 19, Helsingfors, 1902-1903.

Eighteen symbols are used very effectively to show the geological formations in the southeastern part of Finland. Illustrates a monograph of 168 pp., published in the *Bulletin of the Geographical Society of Finland*.

FINLAND.—Schematische Darstellung von Schäden, verursacht durch Überschwemmungen in den Wassersystemen des Kumo-Flusses und der Päijänne- und Saima-Seen im Jahre 1899. No scale. *Fennia* of the Finnish Geographical Society, Vol. 19, Helsingfors, 1902-1903.

Property losses are shown in red, a square millimeter in this colour representing damage to the amount of 500 marks.

FINLAND.—Dolikocefaler (och Bracycefaler) i Finland enligt uppbådsområden. No scale. *Fennia*, Vol. 20, Helsingfors, 1903-1904.

Tints are used to show, in percentages of the total population, the Brachycephalic and Dolichocephalic inhabitants, based upon data collected in the measurement of army recruits.

FRANCE.—*Cartes des Gisements de Coquilles Comestibles, de la Côte du Morbihan comprise entre La Rivière d'Auray et la Rivière d'Etel.* Scale, 1:45,000, or 0.71 statute miles to an inch. By Prof. L. Joubin. *Bulletin de l'Institut Océanographique*, No. 89, Monaco, 1907.

Shows the distribution of shell-fish along a part of the south coast of Brittany. The oyster beds shown in the estuaries of two rivers on this map are especially noteworthy as supplying most of the spat used in the planting of oyster beds along the French coasts.

RUSSIA.—*Übersichtskarte der Halbinsel Kanin.* No scale. *Fennia*, Vol. 21, Helsingfors, 1904-1905.

Illustrates the fruitful explorations of W. Ramsay and B. Poppius on this comparatively unknown peninsula in the north of Archangelsk. The regions of forest, tundra, moraine, hills, mountains, dunes, etc., and also villages and fishing huts are shown.

PACIFIC. *

SAMOA.—*Insel Savaii.* Scale, 6.8 statute miles to an inch. By Dr. B. Funk. *Zeitschrift of the Berlin Geographical Society*, No. 10, 1906.

A sketch map of the island showing the lava flows from Manga Afi, which are at least 200 years old, and within which is the village Aopo on an elevation 200 meters high above the reach of these lava streams; also the areas covered by lava in the eruptions of Matavau from August, 1905, to August, 1906, and in September, 1906. The various old craters found on the island are marked. Illustrates a paper by Prof. Carl Sapper on the volcanic eruptions in Savaii of 1905-6.

WORLD.—*Verteilung der Bevölkerung auf der Erde.* (3) Ein- und Ausfuhr von Getreide. (4) Einwanderung und Auswanderung. By A. Woekow. *Pet. Mitt.*, No. 12, 1906, Justus Perthes, Gotha.

These are the concluding plates illustrating the paper by Prof. Dr. Woekow on the distribution of population over the earth under the influence of natural conditions and human activity. Plates 1 and 2 were noticed in the BULLETIN (Jan., 1907, p. 44). In plate 3 the regions importing grain are shown in yellow; the regions exporting rice are shown in dark green, and those exporting wheat, barley, rye, and maize in light green. The chief trade routes followed by wheat and rice are indicated. Regions receiving immigrants are shown in red, and those from which emigration proceeds, in blue.

ATLAS OF THE WORLD'S COMMERCE.—Compiled from the latest Official Returns at the Edinburgh Geographical Institute. Edited by J. G. Bartholomew. (Parts 18 and 19), George Newnes, London, and Frederick Warne & Co., New York, 1906. (Price, 25 cents a Part.)

Part 18 of this valuable atlas has maps showing the distribution of apples, bananas, oranges, dates and other fruits, the chief apple districts and the distribution of other fruits in North America, fruits in Europe, timber-growing countries of the world, with larger-scale maps for the United States and Canada and the timber-exporting and importing countries. The Commercial Gazetteer of countries and ports is continued with black-and-white maps of Constantinople, Copenhagen, Queenstown, Dover, Dublin, Dundee, and Dunedin.

Part 19 maps the regions of dairy produce and the importing and exporting countries, with more detail on larger-scale maps of the United States, Siberia, and

northwestern Europe; two Mercator maps show the distribution of tin, platinum, aluminum, and eight other minerals. The Commercial Gazetteer is continued with maps of Genoa, Gibraltar, and Glasgow.

ATLAS UNIVERSEL DE GÉOGRAPHIE.—*Ouvrage commencé par Vivien de Saint-Martin et continué par Fr. Schrader.* 90 Maps. No. 77, United States (north-east region). Scale, 1:3,000,000, or 47.34 statute miles to an inch. Hachette & Co., Paris, 1906.

The map is a fine specimen of compilation and engraving. It is based upon the sheets of our topographic survey as far as they have appeared, and where they are lacking the best cartographic data available have been used. A list of the sources from which the map was made is given. The sheet embraces middle Quebec on the north, Norfolk on the south, Mount Desert on the east, and Chicago on the west. The scale is a little larger than that of the best atlas map of the United States and is the most effective small-scale atlas sheet of the region shown that we have seen. The generalization of the contours, from our topographic sheets in the Appalachian region, is especially worthy of note, the mountain ranges being very carefully produced and standing out with the effect of relief.

BOOK NOTICES.

Annual Report of the Mississippi River Commission for the fiscal year ending June 30, 1906, being Appendix MMM of the Annual Report of the Chief of Engineers for 1906. IV and 140 pages (pages 2469-2609). 12 plates. Government Printing Office, Washington, 1906.

This report is a smaller volume than any one which has been issued by the Commission for a number of years. Excessive floods, which have yielded data for reports, and special surveys have been the reasons for the larger volumes. The small size of the report for this year is, in a measure, an indication that no new situations have developed during the fiscal year, that the spring floods were of no great moment, and that no report of any investigating board is published. The report follows the plan of previous reports. It opens with a retrospect of the work of the year, signed by the members of the Commission, and is followed by the statement of appropriations and allotments. The remainder of the volume is given over to reports of those in charge of the various departments and districts.

In many of these reports there is information of value to the geographer. To one unfamiliar with the arrangement of the report it is a time-consuming task to obtain any desired data. No index is appended. The report serves its end without one.

The reviewer has compiled for his own convenience an index of the later reports of the Commission. With the expectation that some reader may desire information from the reports, an abbreviated index of the last report is added:

	PAGE
Appropriations	2470
Atchafalaya River, relation to Mississippi.....	2478-81
diversion of Mississippi through.....	2478
improvement of.....	2581

	PAGE
Cut-offs, condition at Ashbrook Neck.....	2475
condition at Natchez.....	2477
condition in third district.....	2555
Dredging, project.....	2503
operations	2507
results and locations.....	2508-9
Greenville Harbor, improvement of.....	2475
work and condition.....	2553
High water of 1906.....	2484, 2562
operations	2544
protection against, fourth district.....	2596
Hydrographs 1905-6.....	opp. 2528
Levees, yardage for fiscal year.....	2483
loss during year.....	2484
levees abandoned, breaks, high-water effects and caving banks.....	2539-44
work, third district.....	2558-61
Memphis Harbor, improvement of.....	2474
Natchez Harbor, improvement of.....	2477
general project of work.....	2478
threatened destruction.....	2478
operations and results.....	2578
New Orleans Harbor, object of work, project and conditions.....	2482
operations and results.....	2584
Profiles, showing high-water slopes and top of levees.....	opp. 2546 (5 plates).

R. M. B.

Handbuch der Wirtschaftskunde Deutschlands. Herausgegeben im Auftrage des Deutschen Verbandes für das Kaufmännische Unterrichtswesen. 3 vols. Numerous Tables and Maps in the Text. Vol. 1, v and 331 pp.; Vol. 2, 253 pp.; Vol. 3, 1047 pp. large 8vo. B. G. Teubner, Leipzig, 1901-1904. (Price, M. 30.)

About 60 economic specialists in Germany contributed to the production of this very valuable work, which was four years in course of production. The whole field of industries in Germany was covered by expert writers. The result is a work embracing most phases of the economic life of the great nation. The work originated in the general demand from schools in which economic and commercial geography is prominent for a comprehensive hand-book to be used in their courses of study. The existing text-books were inadequate for the needs of this branch of education. The German Association for Commercial Education, therefore, decided to assume the larger part of responsibility for the production of a work which should serve the purposes both of a hand-book and the text-book.

The subject is soundly based and developed with scientific method. The first volume gives 70 large and closely-printed pages to a description of the geography, geology, and soils of Germany, its climatic conditions, its industrial plants, and the animal life of commercial importance. Vol. 2 treats of agriculture, forestry, gardening, wine-growing, stock-raising, bee culture, and the products of the hunt and fisheries; in other words, it deals with the vegetable and animal products which enter into the commerce of the nation. Vol. 3,

which was issued in Parts, and was two years in course of publication, embraces an exhaustive treatment of all the leading industries of the Empire. Vol. 4, which will deal with Germany's commerce and transportation facilities, has not yet come to hand. It is to be hoped that a detailed index will complete the work by making easily available the vast stores of information which it contains. The numerous maps are in colours and relate chiefly to the distribution of the industries.

Woerl's Führer durch Tirol, und die angrenzenden Gebiete. Herausgegeben von Leo Woerl. 326 pp., Plans of Cities, and Map of the Tyrol. Woerl's Reisebücherverlag, Leipzig, 1906. (Price, M. 1.)

A convenient and well-arranged guide-book, with full information for the tourist, including a special chapter for pedestrians and detailed descriptions of 33 tours in the Tyrol, with Munich, Innsbruck, and other cities as the starting-points.

The Development of Palestine Exploration: Being the Ely Lectures for 1903. By Frederick Jones Bliss. xvii and 337 pp., and Index. Charles Scribner's Sons, New York, 1906.

This authoritative book is not a compendium of the results of Palestine exploration. No lists of identified sites are given, and detailed descriptions of the monuments are omitted. The author chooses rather to trace the development of exploration, shows the progress in the art of identifying sites, and notes the influences that, for centuries, have impelled researches. He describes the awakening of the antiquarian spirit that early led to the search for monuments, the displacement in Palestine of the classic geographer by the credulous pilgrim, and of the gradual evolution of the pilgrim into the man of science. His pages seem to show that the ideal explorer of the Holy Land has not yet been realised, and perhaps never will be; for he must combine "the qualities of a geographer, a geologist, a naturalist, an historian, an epigraphist, a Biblical student, a painter, a mystic and a poet." Dr. Bliss says that the future explorer of Palestine must be a specialist. Exploration above ground will soon become restricted to the study of particular questions. The explorer can no longer expect to come suddenly upon an unknown town. He must enter Palestine with an especial purpose, if he seeks to add to general knowledge.

Les Daimyo Chrétiens. Par M. Steichen. x and 454 pp., and Index of Names. Société des Missions Etrangères, Hongkong, 1904. (Price, \$3 Mex.)

The book gives the religious and political history of Japan during the century from 1549 to 1650, when the Japanese were amenable, for a time, to some Western influences, including the Christian propaganda. Then the doors abruptly closed again, and Japan was once more wholly cut off from the Occident. The letters of missionaries who in that epoch devoted their lives to work in Japan are the basis of the book, and the numerous native histories have afforded much information of importance.

Deux Années au Setchouen. Par Le Dr. A.-F. Legende. (Second Edition.) xvi and 547 pp., half-tone Illustrations, and Map. Plon-Nourrit & Co., Paris, 1906. (Price, Fr. 3.50.)

A superior book written without waste of language, so that a vast amount of information is compactly presented. It is a geographical, social, and economic

study of an interior province which, in its great resources and enormous population, is one of the most conspicuous parts of China. The author has every faith in the further development of the Chinese along the lines of their own high civilisation, as stimulated by Western ideas and methods.

The first part of the book deals with the journey up the Yangtse through the wonderful valley country and of the beauties of the mountain region beyond Ichang. Then, the Western or Alpine region of the Szechuen province is described with its resources and its aboriginal races whom the Chinese drove out of the fertile eastern plains. A long section is given to Chinese civilisation—the family, the social divisions, general culture, arts, industry, etc.—and the author endeavours to describe the mental and spiritual characteristics of the Chinese. The book concludes with a careful account of the races of Szechuen and gives many details of the natural wealth of that favoured region which justify the author's conviction that this part of China is capable of the highest material development. This is one of the best recent books on China.

History of Michigan. By Lawton T. Hemans. 278 pp., Illustrations and Index. Hammond Publishing Company. Lansing, Mich., 1906.

About five pages are given to a description of the geography of the State. It is impossible, of course, to compress into this brief compass the essential geographical facts and a statement of their influence in shaping the industrial and general development of the State. With this inadequacy remedied, the book would seem to be admirably adapted for imparting to students the groundwork of a thorough knowledge of the history of Michigan and the principles of its government.

Wisa Handbook. By A. C. Madan. 136 pp., including an English-Wisa Vocabulary. Clarendon Press, Oxford, 1906. (Price, 3s.)

This little book is an introduction to the Wisa dialect of north-east Rhodesia, a part of the country west of Lake Nyassa, in which British economic enterprises have not yet developed on a large scale. The book shows the strong family likeness of the Wisa to the other Bantu dialects. It makes clear the peculiarities of this dialect and thus smooths the way for its further study. It has recently been found that the country through which the Cape to Cairo Railroad has been pushed to Broken Hill is inhabited by natives speaking a language hardly distinguishable from Wisa, so that Mr. Madan's hand-book will have a wider range than was at first expected. A well-arranged grammar forms Part 1 and the vocabulary is Part 2. Mr. Madan's contributions to the knowledge of African languages are entitled to the highest appreciation.

Hawaii, Ostmikronesien und Samoa. Von Prof. Dr. Augustin Krämer. x and 585 pp., 86 half-tone Illustrations, many Tables and Figures, and Index. Strecker & Schröder, Stuttgart, 1906. (Price, M. 20.)

No higher praise could be given to this book than to say that it is worthy of the fine style in which the publishers have produced it. Type, paper, and illustrations are unexceptionable. Dr. Krämer is a surgeon in the German marine service, and before he made the first of his long journeys through Polynesia he prepared himself at Kiel by zoological, geological, and other scientific studies to render good service as a scientific observer. He is already well

known by his book on the coral reefs and the distribution of plankton along the coasts of Samoa, by other writings on the Samoa islands, and by ethnographical studies in the Marshall archipelago. The present volume is a description of his second long sojourn in the Pacific, when he was engaged from 1897 to 1899 in the study of the atolls and their inhabitants. His travels embraced Hawaii, Samoa, the Marshall, Gilbert, New Caledonia, and Fiji Islands, and his book includes his later observations, generalisations on his ethnographical studies, and the results of his investigation of coral reefs and plankton. Many of his original photographs are especially striking and characteristic.

Anleitung zu wissenschaftlichen Beobachtungen auf Reisen.

Von Prof. Dr. G. Von Neumayer. Two Volumes, Third Edition.

Dr. Max Jänecke, Hannover, 1906. (Price, Vol. 1, M. 25; Vol. 2, M. 24.)

The third edition of this complete and exhaustive work comprises about 1,600 pages. It includes all the latest methods and discoveries with which the explorer in his field work should be familiar; and though the work is bulky and heavy, the traveller who is acquainted with German will doubtless feel that this disadvantage is compensated by the completeness and the scientific quality of the information given. With this work and the "Hints to Travellers," published by the Royal Geographical Society, no traveller can feel that he lacks literary helps in the prosecution of his work. Among the exhaustive articles in these volumes are "Photography as an Aid to Land Surveying," by Prof. S. Finsterwalder; "Magnetic Observations on Land," by Dr. von Neumayer and Dr. J. Edler; notes on "Magnetic Observations on Board Ship," by Dr. Friedrich Bidlingmaier; Dr. Drude on botanical geography; Dr. Schweinfurth on the collection and preservation of plants; and many others. The late Baron von Richthofen, who wrote the long article on geology for the first edition, revised and added to it for the present issue, and his work is of special interest because it contains his final writings on this subject. The entire work undoubtedly cost an enormous amount of labour and the most painstaking care, and Dr. von Neumayer, who is now in his eightieth year, is to be congratulated upon the admirable result of his thorough supervision of these very useful volumes.

Geographisches Jahrbuch. XXIX Band, (Erste Hälfte), 1906.

Herausgegeben von Dr. Hermann Wagner. 238 pp. Justus

Perthes, Gotha, 1906. (Price, M. 7.50.)

This part of the Jahrbuch is given entirely to current geographical literature and cartography of Europe. The notes by Prof. Dr. Th. Fischer on the south European lands (Iberian peninsula, Italy, and the southeast European peninsula) include 256 titles; France, by Prof. Dr. P. Camena d'Almeida, 322 titles; Switzerland, by Prof. Dr. J. Früh, 180 titles; Austria-Hungary (including Bosnia and Herzegovina) by Dr. F. R. Machacek, 529 titles; Rumania, by Prof. Dr. E. de Martonne, 83 titles; Germany, by Dr. O. Schlüter, 530 titles; Great Britain and Ireland, by O. J. R. Howarth, 67 titles; European Russia (including the Caucasus and Russian Armenia) 1894-1905, by Prof. Dr. M. Friederichsen, 488 titles; Denmark, by Prof. Dr. E. Löffler, 61 titles; The Netherlands, by Dr. H. Blink, 29 titles; Belgium, by Prof. F. van Ortry, 172 titles. Sweden and Norway do not appear in this list. The second half of the volume will be issued during the winter.

Étude sur l'État Actuel des Mines du Transvaal. Par George Moreau. iv and 218 pp., Illustrations and Map in text. Ch. Béranger, Paris, 1906. (Price, 7.50 fr.)

The gold mines of the Witwatersrand again lead the world in production. Their output exceeds that of the period just before the Boer war, when, for two years, they first surpassed the gold mines of the United States and Australia. The complete revival of these great mining enterprises gives this book, the result of careful studies by Mr. George Moreau, a French mining engineer, especial timeliness. He presents with adequate fulness, though compactly, a clear idea of the many factors in the wonderful development of Transvaal gold mining. He deals first with the Transvaal in its geographical aspects, its history, government, and population, its mining régime and its labour problems; thirty-four pages are given to the geology of the country, and especially of the Rand; then he describes the Rand and the formation of its reefs or gold-bearing outcrops, as we would call them. A long chapter is devoted to all phases of the exploitation of these mines, and finally the author discusses the financial aspects of the mining enterprises, the prospects of profitable deep-level mining, and the future of the Rand.

Mr. Moreau believes that mining will continue to be a great industry on the Rand for fifty or sixty years to come. The annual extraction of gold is now about \$100,000,000, and the annual yield is quite certain to exceed this amount for years to come. The dividends distributed among the stockholders of the mining companies are about \$20,000,000 a year, or about one-fifth the value of the metal extracted. It is probable that, as yet, the Rand has yielded only about a tenth of the gold it contains.

At the end of 1905 nearly 20,000 whites, over 100,000 blacks, and about 50,000 Chinese were employed on the Rand. The blacks, usually hired for six months, go home at the end of their agreed term without having become very efficient. The Chinese, engaged for three years, receive smaller wages than the blacks, but the cost of recruiting, transporting and housing them is large. The white workmen are opposed to Chinese labour, and the Government has really been compelled to admit coolies under such restrictions as prevent them from rendering the best service in their power.

Mr. Moreau believes that the gravest phases of the labour question relate more to the excessive wages which the white personnel receive than to the black or yellow workmen. He has much faith in the future of deep-level mining, unless enterprise in this direction is defeated by the demands of white labour for excessive remuneration.

Most of the book is adapted for the general reader, though the account of the mining methods is more or less technical. Numerous woodcuts, maps, profiles, geological sections, etc., are scattered through the book. Mr. Moreau's contribution to the literature of the Witwatersrand is comprehensive and authoritative.

The Romanization of Roman Britain. By F. J. Haverfield. 33 pp., and 13 Figures. Published for the British Academy by Henry Frowde (*Proceedings of the Brit. Acad.*, Vol. II.) London, 1906. (Price, 2s. 6d.)

The Roman civil and military districts in Britain covered the larger part of England, but did not extend into Scotland. Most English writers describe Roman Britain as a province in which Roman and native were as distinct as modern

Englishman and Indian, "the departure of the Romans in the Fifth century leaving the Britons almost as Celtic as their coming had found them." The author surveys the scanty remains of the Roman occupancy in disproof of this opinion.

In respect of language he finds that British princes before the Claudian conquest of A.D. 43 had begun to inscribe their coins with Latin words. Latin advanced rapidly after that year and no Celtic inscription is believed to occur on any monument of the Roman period in Britain. On the other hand, Roman inscriptions occur freely. They abound most in the military region, but they appear also in towns and country houses. The excavations at Calleva (Silchester) prove that the public language of the town was Latin. The evidence is clear that Latin was employed freely in the towns not only by the upper classes but also by servants and workpeople.

Passing from language to material civilisation, the author marshals evidence to show that the external fabric of the life of the province was Roman and that the native elements almost wholly succumbed to the Italian influence. The character of the internal fittings of the houses was borrowed from Italian sources. Art remains, however, show definite survivals of Celtic traditions, but the British Celt largely abandoned his national art and adopted the Roman provincial fashion.

The conclusions deduced in this able and interesting monograph are that the empire Romanized the province, introducing Roman speech, thought, and culture; and that in the towns and among the upper classes the Romanization was substantially complete, but the peasantry may have been brought less thoroughly under the influence of the conqueror's civilization.

Lehrbuch der Geologie Von Dr. Emanuel Kayser. In zwei Teilen.

1. Teil: Allgemeine Geologie. Mit 483 Textfiguren. Zweite Auflage. Stuttgart, Ferdinand Enke, 1905.

This second edition of Kayser's text-book of geology is entirely rewritten. The first edition, published in 1893, contained 488 pages and 362 illustrations, while the second edition of 1905 has 725 pages and 483 illustrations. The author follows the three old masters of the science of geology—Lyell, Dana, and Naumann. Many of the photographs in the book were taken by Prof. Kayser and the book contains many original diagrams.

The book is divided into two parts: *Physiographische Geologie* and *Dynamische Geologie*. The first part devotes 78 pages to the consideration of the astronomic and geophysic conditions of the earth. The author begins his study with the idea of the earth as a planet revolving round a sun, which is one of the stars of infinite space. He then considers the air, the water and the rock envelopes of the globe.

He believes in giving a few pages to the subject of petrography in a book on general geology, because he regards it as necessary to have some knowledge of that subject. The structure of the crust of the earth is described and typical sections and diagrams are given. Two hundred and ten pages are devoted to the subjects considered in the first part.

The following illustrations are particularly good: Jordan Valley (p. 102), Weathered forms of rock (p. 130), Veins and dikes (p. 150), Structure of eruptive rocks (p. 155), Mountain section (p. 168), Faults (p. 178), and Graben (p. 189).

Five hundred pages are devoted to Dynamical Geology, in two divisions: Exogenous Processes, 200 pages, and Endogenous Processes, 300 pages.

The action of the wind in wearing away and building up the surface of the earth is considered; then the activities of water, and also the geological action of plants and animals. The photograph of the delta of the Julier brook where it empties into the lake of Silvaplana in the upper Engadine is a remarkably fine example of a delta formed in still water (page 351). The photograph and map of the Aletsch glacier (pages 391 and 392) are well chosen for class instruction. The historical changes of the coast-line of Heligoland and other islands off the west coast of Germany are well shown (pages 435-438).

A very educative photograph is reproduced on page 469. This shows tree stumps standing in their original position in the workings of the Victoria soft coal region of the Lausitz. The connection between the swamps of to-day and those which must have existed in Carboniferous time is clearly brought out.

The relation between the modern coal deposits and the dolomite deposits of the Tyrol is discussed with diagrams, section, and maps.

Volcanic phenomena are first considered among the endogenous processes. Diagrams, photographs, sections, and maps are freely used, and generally these are well selected from the extensive literature on the subject. Vesuvius, Krakatoa, and Pelée are among the principal examples given. The shaded map of Vesuvius, showing the old and recent lava flows (page 547), is particularly good for students.

The stages of dissection of a volcano are too briefly treated, with abrupt transition from the initial conical form to the exposed roots of ancient volcanoes.

Earthquakes are well treated, and some very good illustrations are given. The method of determination of the centre of the movement is well shown by diagram and photographs of injured buildings. The vertical and horizontal elements of movement are distinguished.

Earthquakes are classed as (1) Landslide; (2) Volcanic; (3) Tectonic or Dislocating.

Mountain building is summarized in 25 pages. Earth forms are discussed under the two heads, concave forms and convex forms. The relation of the processes of mountain building to these two large classes is shown to be very close.

Under *Schwellformen des Bodens* are grouped the following convex forms:

1. Volcanic *Ausbruchs* mountains.

2. *Schollengebirge*, including both plateaus like the Wasatch and block mountains like the Basin Ranges.

3. *Jugendliche Faltungsgebirge*. The type of this mountain form is given as the Caucasus. A belt of the more recently folded mountains of the world is given, beginning at Patagonia, going up the western coast of South America, through Venezuela and the West Indies to Yucatan, thence through Mexico and Western North America to Alaska, thence through the Aleutian Islands to Kamchatka and Japan, thence through the Philippines to the East Indies, where an arm of the belt goes through New Guinea to New Zealand, the main belt extending through Java, Siam, and eastern India to the Himalaya mountains, thence through Afghanistan, Persia, and Turkey to southern Europe, the belt ending in Spain and Morocco.

4. *Rumpf*, or *Massengebirge*. The type of these older, worn-down mountains is the Thüringer Wald.

The influence of mechanical metamorphism on rock structure is next discussed.

Relative elevation or depression of continents is discussed in 30 pages.

The criteria for elevation are, raised beaches, marine shells and pebbles, marks left by boring marine animals, deltas, above water-level, and harbour structures

and wrecked ships above sea-level. The criteria for depression are, buildings and streets beneath the sea, trees and peat under sea-level, drowned valleys, a lack of delta building, and drowned volcanic craters.

The author fails to recognize the changes which take place along elevated and depressed shore-lines, thus leaving out the consideration of the time since elevation or depression. For example, he uses drowned valleys, but not the islands which must result from the same depression. These islands will in time become tied on to the nearest land with sandbars or *tomboli*.

The causes of continental movements are considered and the hypothesis of Suess is discussed. Contact metamorphism is briefly summarized.

F. P. G.

Esto Perpetua: Algerian Studies and Impressions. By H. Belloc.

London, Duckworth & Co. 8vo. 1906.

This handsome little book, with its exquisite illustrations in the text, and with sketch maps of a quite indifferent character, can hardly be classed with geographical literature. Of course, descriptions of landscape and of nature in general abound, but there is nothing sufficiently special to authorize its classification as a contribution to the science. It reads as if written by the author for himself and a few intimate friends, rather than for the public. Barbary is the theme, its history, cultural development, etc., but no period of the history of its inhabitants is dwelt upon in a satisfactory manner, and there are digressions that appear not only unnecessary but confusing. The author opens with a long and ornate disquisition on the Latin (*lateen* as emphasized) sail and its influence on the spread of the Arabs, and then jumps from site to site along the coast, dashes inland to Constantine, contemplates the Atlas and grazes the Sahara, all in a rambling, cursory manner, which presupposes too much from the uninformed and is not specific enough for him who knows of and takes an interest in the people and countries. Meditations too often take the place of statements of interesting facts. The tone, however, is pleasing, free from conceit or national prejudice; what is said of people is given in a mild and eminently friendly manner, that sharply contrasts with the aggressive and harsh judgments too many travellers are wont to express. It is a book that can be sincerely commended to the general reader, less for the information it contains than for its amiable tone and modest character.

A. F. B.

The Republic of Colombia. By F. Loraine Petre. London, E. Stanford, 1906. (8s. 6d.)

A very useful, singularly modest and impartial book, written by an Englishman. One would hardly suspect it, so modest and "unBritannic" is the style, so fair the treatment other nations receive at the hands of the writer. Fair in almost every respect, Mr. Petre presents a good picture of lands and their inhabitants, his historical allusions are short and, with the exception of a few harsh sentences about Spanish conquest and early treatment of the aborigines, quite exact. The brother of Gonzalo Jiménez de Quesada, Hernan Pérez, indeed gave cause for very severe judgment. Otherwise, a better knowledge of the nature of the Indian and more discrimination as between military necessities and civil administration would place many deeds in a different light. It is time, also, for a revision of the life of Bolívar and the exalted opinion in which he is still held. Too much, entirely too much, credit is given to him. To call him always the "Washington of South America" is not strictly complimentary to the memory of him who, with much more propriety and justice, is termed the "Father of our country." To cite but one instance: Washington was a remarkable military man. He was in

the field, and, from boyhood on almost, distinguished himself far above the British general officers under whose orders he fought in his early days. Afterwards, when the Revolution was in full blast, he met with reverses, but these were due chiefly to the failings common to raw militia, lack of subordination and experience. Bolivar had the title of general and the rank. He commanded in a single action of consequence, the decisive battle at Junin (Ayacucho), and, as long as he was upon the field, the day was lost for the side he commanded. It was won in the end, but not through any merit of his. This is but one instance to show how little Bolivar deserves the admiration bestowed upon him. The allusions to history in the book are, however, only incidental. Nature, the actual condition of the country and the people, the prospects from a commercial and industrial point of view, and the political situation with its influence—these form the theme. The illustrations are good, though the river-views are little more than a portrait-gallery of antiquated wheel-steamer.

In his rapid survey, Mr. Petre does not, of course, include Panama, which, when he wrote, was already "independent," for the sake of the canal. He is tactful enough not to waste any words on the separation of the Isthmus from the mother country, but simply alludes to it as a *fait accompli*, against which there is no remedy for the Colombians.

In a manner as pleasing as it is skilful, the author guides his reader through an elaborate statistical account of the Republic of Colombia. There are a number of short, well-selected and well-arranged tables, but they are so placed and distributed as to appear like incidental illustrations to a generally fascinating text. Fascinating, above all, through its simplicity. There are few outbursts of feeling over the actions of men and no bombastic raptures over beauties of nature. To those of us who have travelled through or lived in the tropical high timber descriptions of animal life, as Mr. Petre observed it in the Colombian woods, is satisfactory reading, in that he states: "Bird and insect life is ever present in infinite variety. . . . But of the mammalia one sees or hears little." Only about the mighty rivers do higher types of mammals occasionally appear in the daytime; the forests are usually silent and seem deserted. We know of a very skilful collector of insects in South America who, in daily excursions for five months spent in the midst of forests known to be peopled by quadrupeds, birds, and especially by reptiles, found only a few parrots, and one single snake.

To the miner and mineralogist, Mr. Petre's description of the emerald-bearing sites in the ancient province of Muzos and his report of the manner of working them, is of interest, if not of positive value. A glance at the mineral wealth of the country informs us of the existence and locations of ores and other minerals, among which platinum plays no unimportant role. That the useful products of the vegetable kingdom are not omitted, but receive their due share of attention in a popular book of this character, need hardly be stated. The diversity of climatic zones through which Colombia ranges from the seaboard to the summits of the Cordillera, produces a corresponding variety of plants useful to man, among which, for the present, coffee and cacao are the principal ones improved for commercial purposes. But he sees "openings" for many others, now neglected, such as sugar, rice, &c.

On the whole, Mr. Petre may be congratulated upon the contribution to economic geography he has furnished, in this sketch of the most northwesterly of South American States. It is a meritorious effort, and would be still more so had he been able to go into greater detail on many points in relation with his general subject.

A. F. B.